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MINERAL RESOURCES
OF THE
UNITED STATES
1929

PART II—NONMETALS

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U. S. DEPARTMENT OF COMMERCE
R. P. LAMONT, Secretary
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MINERAL RESOURCES OF THE UNITED STATES

1929

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PART II—NONMETALS

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FLUORSPAR AND CRYOLITE[1]

By Hubert W. Davis

FLUORSPAR

Fluorspar (or fluorite) is a compound of calcium and fluorine, and chemically consists of 51.1 per cent of calcium and 48.9 per cent of fluorine. It has a specific gravity of 3.2, is brittle, has a hardness of 4, can be scratched easily with a knife, weighs about 200 pounds per cubic foot, and has a melting point of 1,650° F. Fluorspar crystallizes in the isometric system and is often found in cubical crystals. It is a mineral of many colors, ranging according to purity from a clear, colorless, or slightly bluish glasslike substance through various hues of purple, green, yellow, pink, lavender, and brown. Most fluorspar contains silica or calcite, or both, and usually some iron oxide and alumina. Other more or less common associated minerals are barite, galena, and sphalerite.

A noteworthy accomplishment in the fluorspar industry in 1929 was the placing of the flotation mill at Rosiclare, Ill., in commercial operation on March 18 by the Franklin Fluorspar Co. This company has for several years been carrying on extensive studies and experiments with a view to finding a method whereby an acid-grade fluorspar could be recovered from fluorspar ores. That these studies and experiments have proved successful is evidenced by the results of the run of this mill in 1929, when a feed of 11,868 short tons of mill tails containing 60 per cent, more or less, of calcium fluoride yielded 3,062 tons of concentrates suitable for use in the manufacture of hydrofluoric acid.

PRODUCTION AND SHIPMENTS

Domestic producers shipped 10 per cent more fluorspar to steel plants in 1929 than in 1928, and exports of fluorspar increased 27 per cent. There was a decrease in shipments of fluorspar in 1929 to each of the other industries in which the mineral is used. Shipments of acid-grade fluorspar from domestic mines in 1929, although 19 per cent less than those in 1928, were equivalent to about 83 per cent of the total fluorspar consumed in the United States in 1929 in the manufacture of hydrofluoric acid, whereas shipments of domestic acid-grade fluorspar in 1928 were equivalent to only about 78 per cent of the total.

In 1929 shipments of fluorspar from domestic mines aggregated 146,439 short tons, valued at $2,791,126, an increase of 4 per cent in quantity and of 5 per cent in total value as compared with 1928. In 1929 the general average value for all grades per ton f. o. b. mines or shipping points was $19.06, 15 cents more than the 1928 average.

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[1] Work on manuscript completed March, 1930.

The value recorded for the domestic fluorspar is the price paid f. o. b. mine shipping point by the consumer and excludes the cost of containers. In 1929 the general average value of the fluorspar shipped to steel plants from the Illinois-Kentucky district was $17.36 a ton and from the Colorado-New Mexico district $12.69 a ton. This difference in average values represents chiefly economic factors in marketing rather than differences in quality of fluorspar from these two districts.

The table that follows presents such details of the shipments of fluorspar for 1926 to 1929, by States, as may be published without revealing statistics of individual producers except by permission.

Fluorspar shipped from mines in the United States, 1926–1929

State	Gravel			Lump			Ground			Total		
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
1926												
Illinois	47, 254	$812, 129	$17. 19	1, 780	$108, 710	$20. 54	4, 700	$363, 713	$32. 26	53, 734	$1, 012, 879	$18. 85
Kentucky	53, 386	912, 525	17. 09	2, 641			6, 467			62, 494	1, 167, 129	18. 68
New Mexico	1, 063	144, 200	12. 59	820			106			1, 989	161, 269	12. 98
Colorado	10, 389			51			----------	----------	----------	10, 440		
	112, 092	1, 868, 854	16. 67	5, 292	108, 710	20. 54	11, 273	363, 713	32. 26	128, 657	2, 341, 277	18. 20
1927												
Illinois	38, 970	656, 863	16. 86	2, 471	105, 062	21. 18	4, 565	330, 356	31. 31	46, 006	863, 909	18. 78
Kentucky	50, 533	839, 933	16. 62	1, 454			5, 508			57, 495	1, 040, 338	18. 09
New Mexico	1, 562	102, 514	13. 61	574			477			2, 613	130, 481	14. 43
Colorado	5, 971			461			----------	----------	----------	6, 432		
	97, 036	1, 599, 310	16. 48	4, 960	105, 062	21. 18	10, 550	330, 356	31. 31	112, 546	2, 034, 728	18. 08
1928												
Illinois	56, 555	876, 819	15. 50	4, 066	161, 603	26. 12	5, 263	368, 417	29. 99	65, 884	1, 154, 983	17. 53
Kentucky	62, 528	1, 212, 760	19. 40	1, 428			5, 791			69, 747	1, 426, 766	20. 46
New Mexico	961	36, 955	12. 58	399			1, 229			2, 589	74, 805	15. 40
Colorado	1, 562			253			----------	----------	----------	1, 815		
Nevada	415			40			----------	----------	----------	455		
	122, 021	2, 126, 534	17. 43	6, 186	161, 603	26. 12	12, 283	368, 417	29. 99	140, 490	2, 656, 554	18. 91
1929												
Illinois	59, 101	1, 046, 748	17. 71	2, 926	201, 725	24. 23	4, 982	358, 147	32. 38	67, 009	1, 284, 834	19. 17
Kentucky	60, 393	1, 087, 593	18. 01	4, 356			6, 078			70, 827	1, 390, 603	19. 63
Colorado	4, 508	96, 913	12. 82	300			----------	----------	----------	4, 808	56, 607	11. 77
New Mexico	2, 295			143			----------	----------	----------	2, 438	59, 082	15. 57
Nevada	757			600			----------	----------	----------	1, 357		
	127, 054	2, 231, 254	17. 56	8, 325	201, 725	24. 23	11, 060	358, 147	32. 38	146, 439	2, 791, 126	19. 06

HISTORY OF PRODUCTION

The accompanying table presents statistics of the production of fluorspar by States, beginning with 1880. The record of production before 1880 was not obtained, and the statistics for Kentucky and Colorado are incomplete for certain years after 1880, so that more fluorspar has been mined than the table shows. The unrecorded output must be small, however, since the advantages of fluorspar over limestone as a flux in basic open-hearth steel plants have been generally recognized only since about 1899. Before that time fluorspar was used mainly in the preparation of hydrofluoric acid and in the manufacture of opalescent glass; consequently the demand was small.

The production of fluorspar by years for 1880 to 1904, a brief discussion of the history of mining in the different States, and estimates of unrecorded output in early years are given in Mineral Resources, 1925, Part II, pages 9 to 14.

Fluorspar produced[1] *in the United States, 1880–1929, by States*

Year	Arizona		Colorado		Illinois		Kentucky		Nevada		New Hampshire		New Mexico		Tennessee		Utah		Washington		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1880–1904	654	$6,593	------	------	169,870	$1,037,399	134,186	$740,467	------	------	------	------	------	------	400	$3,400	------	------	------	------	305,110	$1,787,859
1905	------	------	1,156	$8,200	33,275	220,206	22,694	132,362	------	------	------	------	------	------	260	1,720	------	------	------	------	57,385	362,488
1906	------	------	300	1,800	28,268	160,623	11,868	79,802	------	------	------	------	------	------	360	1,800	------	------	------	------	40,796	244,025
1907	------	------	3,300	11,400	25,128	141,971	21,058	133,971	------	------	------	------	------	------	------	------	------	------	------	------	49,486	287,342
1908	34	252	701	4,266	31,727	172,838	6,323	48,642	------	------	------	------	------	------	------	------	------	------	------	------	38,785	225,998
1909	30	435	350	2,100	41,852	232,251	7,800	53,233	------	------	------	------	710	$3,728	------	------	------	------	------	------	50,742	291,747
1910	------	------	268	1,608	47,302	277,764	17,003	124,574	------	------	------	------	4,854	26,250	------	------	------	------	------	------	69,427	430,196
1911	------	------	721	4,226	68,817	481,635	12,403	96,574	------	------	800	$6,400	4,307	22,612	------	------	------	------	------	------	87,048	611,447
1912	------	------	1,639	9,834	103,937	695,467	10,473	61,186	------	------	300	1,500	196	1,176	------	------	------	------	------	------	116,545	769,163
1913	100	800	4,432	26,592	85,854	550,815	19,622	113,903	------	------	200	1,200	5,372	42,976	------	------	------	------	------	------	115,580	736,286
1914	------	------	1,978	12,992	73,811	426,063	19,077	128,986	------	------	250	2,000	------	------	------	------	------	------	------	------	95,116	570,041
1915	------	------	247	1,482	116,340	624,040	19,219	129,873	------	------	650	5,200	485	3,880	------	------	------	------	------	------	136,941	764,475
1916	199	2,587	8,669	42,457	126,369	746,150	19,698	123,596	------	------	800	7,864	------	------	------	------	------	------	------	------	155,735	922,654
1917	135	1,080	17,104	196,633	156,676	1,373,333	43,639	697,566	------	------	1,274	19,110	------	------	------	------	------	------	------	------	218,828	2,287.722
1918	364	5,537	38,475	416,780	132,798	2,887,099	87,604	2,069,185	------	------	1,059	21,243	3,437	64,348	------	------	20	$465	60	$824	263,817	5,465,481
1919	45	450	9,687	150,739	92,729	2,430,361	32,386	883,171	400	$5,600	531	12.826	2,346	37,643	------	------	166	4,784	------	------	138.290	3,525,574
1920	181	3,264	12,852	251,308	120,299	3,096,767	46,091	1,246,942	532	8,672	202	4,040	6,353	101,460	------	------	268	6,094	------	------	186,778	4,718,547
1921	------	------	3,143	39,907	12,477	315,767	15,266	294,513	------	------	567	13,721	3,507	60,186	------	------	------	------	------	------	34,960	724,094
1922	------	------	2,309	20,169	83,855	1,493,188	52,484	970,059	------	------	690	15,353	2,180	30,992	------	------	78	1,404	------	------	141,596	2,531,165
1923	------	------	6,044	59,710	65,045	1,443,490	45,441	945.402	------	------	142	3,160	4,328	50,861	------	------	188	3,196	------	------	121,188	2,505,819
1924	------	------	12,301	135,411	62,067	1,288,310	47,847	988,940	------	------	------	------	2,580	35,178	------	------	184	3,292	------	------	124,979	2,451.131
1925	------	------	11,776	153,707	54,428	1,024,516	44,826	833,794	------	------	------	------	2,639	40,325	------	------	------	------	------	------	113,669	2.052,342
1926	------	------	10,440	[2] 161,269	53,734	1,012,879	62,494	1,167,129	------	------	------	------	1,989	(2)	------	------	------	------	------	------	128,657	2,341,277
1927	------	------	6,432	[2] 130,481	46,006	863,909	57,495	1,040,338	------	------	------	------	2,613	(2)	------	------	------	------	------	------	112,546	2.034,728
1928	------	------	1,815	[2] 74,805	65,884	1,154,983	69,747	1,426,766	455	(2)	------	------	2,589	(2)	------	------	------	------	------	------	140,490	2,656,554
1929	------	------	4,808	56,607	67,009	1,284,834	70,827	1,390,603	1,357	(3)	------	------	2,438	[3] 59,082	------	------	------	------	------	------	146,439	2.791,126
	1,742	20,998	160,947	[2] 1,974,483	1,965,557	25,436,658	997,571	15,921,577	2,744	[2, 3] 14,272	7,465	113,617	52,923	[2, 3] 580,697	1,020	6.920	904	19,235	60	824	3,190,933	44,089,281

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[1] Beginning with 1906 figures represent shipments from mines.

[2] Value for New Mexico for 1926, 1927, and 1928 and for Nevada for 1928 included with Colorado.

[3] Value for Nevada for 1929 included with New Mexico.

SHIPMENTS, BY USES

The two tables that follow show the relative dependence of the fluorspar industry on the different industries in which fluorspar is used. The predominance of the steel industry as a purchaser of fluorspar is evident. The high value of fluorspar for hydrofluoric acid, glass, and enamel is due to the high quality demanded.

Fluorspar shipped from mines in the United States, 1928 and 1929, by uses

Use	1928				1929			
	Percentage	Short tons	Value		Percentage	Short tons	Value	
			Total	Average			Total	Average
Steel	76.92	108,064	$1,641,190	$15.19	81.20	118,904	$2,031,248	$17.08
Foundry	2.63	3,694	66,215	17.93	2.39	3,498	69,712	19.93
Glass	4.63	6,499	195,885	30.14	3.92	5,742	183,641	31.98
Enamel and vitrolite	3.35	4,713	142,495	30.23	2.65	3,879	125,646	32.39
Hydrofluoric acid and derivatives	11.35	15,946	585,092	36.69	8.81	12,906	354,235	27.45
Miscellaneous	.84	1,176	19,091	16.23	.69	1,004	15,023	14.96
	99.72	140,092	2,649,968	18.92	99.66	145,933	2,779,505	19.05
Exported	.28	398	6,586	16.55	.34	506	11,621	22.97
	100.00	140,490	2,656,554	18.91	100.00	146,439	2,791,126	19.06

Fluorspar shipped from mines in the United States, 1920–1929, by uses

Year	Steel		Foundry		Glass		Enamel and vitrolite	
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value
1920	151,311	$22.43	(1)	(1)	[2] 10,756	[2] $44.11	(2)	(2)
1921	25,553	15.94	1,521	$20.14	[2] 5,599	[2] 40.03	(2)	(2)
1922	122,403	16.24	2,998	19.02	[2] 8,904	[2] 36.29	(2)	(2)
1923	96,713	18.23	3,748	21.20	[2] 10,768	[2] 36.17	(2)	(2)
1924	104,349	17.72	7,138	22.35	6,094	35.16	3,471	$34.85
1925	91,760	16.16	6,275	19.31	6,767	31.23	3,237	31.22
1926	105,614	16.51	6,212	19.55	7,507	32.01	3,410	33.27
1927	93,196	16.35	4,533	18.69	5,968	30.91	3,813	31.44
1928	108,064	15.19	3,694	17.93	6,499	30.14	4,713	30.23
1929	118,904	17.08	3,498	19.93	5,742	31.98	3,879	32.39

Year	Hydrofluoric acid and derivatives		Miscellaneous		Exported		Total	
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value
1920	19,498	$36.86	[1] 2,449	[1] $27.19	2,764	$23.69	186,778	$25.26
1921	1,833	28.62	454	21.23	----------	----------	34,960	20.71
1922	4,782	24.81	213	18.02	2,296	17.84	141,596	17.88
1923	6,976	30.19	1,839	20.85	1,144	22.13	121,188	20.68
1924	3,150	28.39	160	21.13	617	23.48	124,979	19.61
1925	4,455	25.60	120	39.00	1,055	16.66	113,669	18.06
1926	3,410	23.20	372	21.47	2,132	16.38	128,657	18.20
1927	3,748	26.24	903	17.59	385	19.50	112,546	18.08
1928	15,946	36.69	1,176	16.23	398	16.55	140,490	18.91
1929	12,906	27.45	1,004	14.96	506	22.97	146,439	19.06

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[1] Shipments to foundries included under "Miscellaneous."
[2] Shipments for enamel and vitrolite included with shipments for glass.

INDUSTRY IN 1929, BY STATES

COLORADO

Shipments of fluorspar from Colorado mines in 1929 amounted to 4,808 short tons, an increase of 165 per cent over 1928. Of the 1929 total, 4,508 tons was for use in basic open-hearth steel plants and the remainder (300 tons) for use in foundries.

In 1929, as in 1928, the greater part of the fluorspar produced in Colorado was from mines in the Jamestown district, Boulder County.

The chief producing mine in Colorado in 1929 was the Emmett mine near Jamestown; its output was about 8,000 short tons of run-of-mine fluorspar, from which were recovered 2,640 tons of fluorspar concentrates of fluxing grade and 300 tons of foundry lump fluorspar. The ore from this mine is treated in the Lehman mill at Jamestown; this mill consists of a crusher, screens, jigs, and tables. The finished product is hauled 18 miles to Boulder, the railroad shipping point.

The Nations Treasure mine near Jamestown shipped 152 tons of run-of-mine fluorspar to the steel works at Pueblo, Colo., in 1929. The Consolation mine, also near Jamestown, shipped 1 carload.

The Chancellor mine near Jamestown yielded 408 tons of run-of-mine fluorspar, most of which was shipped to the steel plant at Pueblo.

A new development in Colorado in 1929 is in Chaffee County near Salida, from which a small quantity of fluorspar was mined and shipped to the steel plant at Pueblo. The ore from this property is hauled 3 miles to Brown Canon, Colo., the railroad shipping point.

The Wagon Wheel Gap mine, 1¼ miles southwest of Wagon Wheel Gap in Mineral County, inactive in 1928, was reopened in 1929 and produced and shipped a substantial tonnage of fluorspar to the steel plant of the Colorado Fuel & Iron Co. (the owner of the mine) at Pueblo.

The names and addresses of the producers of fluorspar in Colorado in 1929 follow.

Producers of fluorspar in Colorado in 1929

Colorado Fuel & Iron Co.	Denver, Colo.
Deafon, J. C.	Salida, Colo.
Dopp, Fred C.	Jamestown, Colo.
Evans, John	Jamestown, Colo.
Lehman Fluorspar Co.	Do.
Terry, E. R.	Do.

ILLINOIS

In 1929 about 122,000 short tons of fluorspar-bearing rock, equivalent to about 68,000 tons of merchantable fluorspar, was mined at 15 mines or prospects in Illinois. The quantity of fluorspar of Illinois origin milled in 1929 aggregated about 125,000 tons, from which was recovered about 71,000 tons of merchantable fluorspar—a loss of 54,000 tons in milling and a ratio of 1.76 :1. In 1929 shipments of fluorspar from Illinois to consumers amounted to 67,009 short tons, an increase of 1.7 per cent over 1928; of the total, 19,536 tons was moved to its destination by the Ohio River. The fluorspar shipped from Illinois in 1929 was reported distributed among the various industries as follows:

Distribution among the various industries of fluorspar from Illinois in 1929

Industry:	Short tons
Steel	58, 153
Foundry	1, 388
Glass	2, 309
Enamel	1, 694
Hydrofluoric acid	3, 411
Miscellaneous	33
Exported	21
	67, 009

The Daisy mine on the Daisy vein was again the largest producer of fluorspar in Illinois. The output of this mine was supplemented by some production from the Eurekas mine on the north extension of the Rosiclare vein. The output of crude ore from these mines in 1929 was 3 per cent more than in 1928. The quantity of crude ore milled in 1929 was about the same as that milled in 1928; the quantity of finished product, however, was 12 per cent greater, as the grade of crude ore mined and treated was higher in 1929. Exploration and development accomplished at these mines were entirely satisfactory. At the Daisy mine a large ore body was opened up and developed to the 637-foot level; the main shaft was sunk from the 412 to the 637 foot level to serve this new ore body and to eliminate the use of a winze connecting these two levels in the south part of the mine.

Milling operations at the Rosiclare mill, in which the ore from the Daisy and Eurekas mines is treated, were continued on a 2-shift basis. On the day shift a No. 1 grinding gravel containing 95 to 98 per cent of CaF_2 and a No. 3 or middling gravel containing about 75 per cent of CaF_2 are produced from the jigs. The No. 3 or middling gravel is remilled on the night shift, when a further tonnage of high-grade grinding gravel is extracted. This practice permits the recovery of a much higher percentage of high-grade material, which commands a better market price. In 1928, in connection with the change in operating practice, two new jigs and rolls, elevators, hummer screens, and bins were installed to clean the high-grade concentrates, and in 1929 still further refinements were effected in the milling operation. Of the total shipments from the Rosiclare mill in 1929, 84 per cent went to metallurgical industries, 13 per cent to ceramic industries, and 3 per cent to chemical industries. Of the total shipped, about 31 per cent went to its destination by the Ohio River.

The Hillside mine on the eastern extension of the Rosiclare vein was worked on about the same scale in 1929 and 1928. The quantity of crude ore milled in 1929 was about the same as that milled in 1928; the quantity of finished product, however, was about 26 per cent less, as the grade of crude ore mined and treated was lower in 1929. Shipments from the Hillside mine in 1929 consisted chiefly of gravel fluorspar shipped to steel plants, but some fluorspar was shipped to foundries and a small quantity of acid-grade lump fluorspar was sold for use in the manufacture of hydrofluoric acid. A modern river loading station to provide for the shipping of fluorspar from the Hillside mine to its destination by the Ohio River was completed during 1929. An illustrated article in the Iron Trade Review[2] describes this loading station.

One of the outstanding accomplishments in the fluorspar industry in 1929 was the placing of its flotation mill at Rosiclare, Ill., in commercial operation on March 18 by the Franklin Fluorspar Co. At this mill acid-grade concentrates are recovered from mill tailings that heretofore were believed to be worthless. In 1929 a total of 11,868 short tons of tailings was treated in this mill, from which were recovered 3,062 tons of No. 1 concentrates suitable for use in the manufacture of hydrofluoric acid and 575 tons of No. 2 concentrates suitable for use in the manufacture of cement. Most of the mill tailings treated in this mill in 1929 were of Kentucky origin, and the concentrates recovered from the tailings originating in Kentucky have been credited to Kentucky in the statistics. The mining operations of the Franklin Fluorspar Co. in Illinois in 1929 were confined chiefly to the Hamp mine, 3 miles west of Karbers Ridge.

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[2] Iron Trade Review, River Transportation Facilitates Distribution of Fluorspar: Vol. 85, Dec. 5, 1929, pp. 1443–1444.

At the Spar Mountain mine, 5 miles northwest of Cave in Rock, Ill., the production of crude ore in 1929 decreased 11 per cent from 1928, but the grade of the crude ore mined was considerably higher in 1929 than in 1928. A new and modern mill of 150 tons daily capacity, consisting of log and trommel washers, crushers, rolls, jigs, and tables, was completed and put in operation on May 1. The new mill is at the mine; the old mill was at Cave in Rock. Thus, a considerable saving in transportation costs should follow the change in location of the mill site. On the site of the old mill, which is near the Ohio River, new storage bins of 2,500 tons capacity have been erected; in addition, equipment for loading barges on the Ohio River has been installed. Most of the fluorspar shipped from the Spar Mountain mine in 1929 went to its destination by the Ohio River. Practically all of the output was of fluxing grade, but a small quantity of acid-grade fluorspar was also shipped. The mine from time to time yields some clear fluorspar suitable for optical instruments; 752 pounds of this material was sold in 1929.

At the "Victory" mine in Hardin County, 8 miles northeast of Elizabethtown, Ill., two large ore bodies, one of which was partly opened in 1928, were developed in 1929, and a third and still larger ore body lying to the west was found as the result of diamond drilling. A new shaft was started on this third ore body in 1929. The property is being developed by the Victory Fluorspar Mining Co., formerly Outwater, Schwerin & Barnett. The deposit is described in an article by Schwerin.[3] The sales of fluorspar by this company in 1929, virtually all gravel of fluxing grade, were exceeded by those of only two other producers in Illinois. The concentrating equipment at the mine consists of a crusher, a log washer, and a picking belt. The company is erecting loading equipment on the Ohio River at Cave in Rock, from which shipments can be made by barge direct to their destination.

A small quantity of fluorspar was produced and shipped in 1929 from the Lead Hill mine, 4 miles northwest of Cave in Rock.

Prospecting and sinking of a shaft were done in 1929 by R. B. Clement on a prospect near Rosiclare; in the course of this work a small quantity of fluorspar was mined and shipped to the Kentucky mill at Marion, Ky.

Some fluorspar mined in 1924 at the Du Bois mine near Eichorn, Hardin County, was shipped in 1929 to the Franklin mill at Rosiclare.

The Rose mine in Hardin County 7½ miles north of Rosiclare, opened in 1928, was worked about one-third of 1929; it yielded a small quantity of fluorspar, which was shipped to the mills at Marion, Ky.

In the course of prospecting at the Gintert prospect in Hardin County near Karbers Ridge a little fluorspar was mined and shipped to the Franklin mill, at Marion, Ky.

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[3] Schwerin, Martin, An Unusual Fluorspar Deposit: Eng. and Min. Jour., vol. 126, Sept. 1, 1928, pp. 335-339.

In the Cave in Rock district, in addition to the production of the Lead Hill, Spar Mountain, and "Victory" mines, some fluorspar was mined at the Ohio Valley and Austin mines. The Austin mine is a new development, and production was barely started in 1929. The concentrating equipment used in 1929 consisted of washing and screening units; extensive additions are reported under way.

Mining operations at the Empire-Knight-Douglas group of mines in Pope County near Eichorn were on a greatly increased scale in 1929. Of the total shipped from these mines in 1929, about 37 per cent was acid-grade lump fluorspar, 61 per cent was fluxing-grade gravel flourspar, and 2 per cent was foundry lump fluorspar.

A list of the producers of fluorspar in Illinois in 1929, with their post-office addresses, follows.

Producers of fluorspar in Illinois in 1929

Austin Fluorite Co	Cave in Rock, Ill.
Basic Mineral Co	Pittsburgh, Pa.
Benzon Fluorspar Co	Cave in Rock, Ill.
Clement, R. B	Marion, Ky.
Franklin Fluorspar Co	Paducah, Ky.
Hillside Fluor Spar Mines	Chicago, Ill.
Knight, Knight & Clark	Rosiclare, Ill.
Lay, Arthur J	Do.
Roberts & Frazer	Marion, Ky.
Rosiclare Lead & Fluorspar Mining Co	Cleveland, Ohio.
Victory Fluorspar Mining Co	Elizabethtown, Ill.

KENTUCKY

In 1929 fluorspar-bearing rock equivalent to about 71,000 short tons of merchantable fluorspar was mined from 42 mines or prospects in Kentucky; shipments of fluorspar from Kentucky to consumers amounted to 70,827 short tons, an increase of 1.5 per cent over 1928. The shipments were the second largest recorded for the State and for the fifth time since 1904 exceeded those of Illinois. The shipments of fluorspar from Kentucky in 1929 were distributed among the industries as follows:

Distribution among the various industries of fluorspar from Kentucky in 1929

Industry:	Short tons
Steel	52, 952
Foundry	1, 439
Glass	3, 433
Enamel	2, 136
Hydrofluoric acid	9, 411
Portland cement	911
Miscellaneous	60
Exported	485
	70, 827

Caldwell County.—In Caldwell County, where the deposits of fluorspar occur east and southeast of Fredonia and north and northwest of Princeton, mining was on about the same scale as in 1928.

The chief producing mines in Caldwell County in 1929 were those of the S. L. Crook Corporation near Crider. This corporation acquired by lease in 1929 the Marble property, about 4 miles east of Fredonia. The crude ore from these mines is hauled to the mill at Crider, where it is prepared for the market. All the fluorspar recovered in 1929 was of fluxing grade, and practically all was shipped to steel plants.

The Eureka mine (formerly the Crider), 3½ miles from Crider, inactive in 1927 and 1928, was reopened the latter part of 1929, and some fluorspar was mined and sold to local mills.

At the Walker mine, 3 miles north of Crider, development was continued in 1929; in the course of this work some fluorspar was mined and sold to local mills.

Crittenden County.—In 1929 the Franklin Fluorspar Co. worked, more or less, the Mary Belle, Brown, Hodge, Memphis, Split Nickel, Loveless, Susie Beeler, Ada Florence, Beard, Cross, Franklin, and Hoover mines, 5 to 15 miles from Marion, Ky. In addition, the company purchased some of the output of many local mines, chiefly the Watson, Guill, Crystal, Nancy Hanks, Holly, Pigmy, Blue & Marble, and Davenport. The company has a well-equipped mill at Marion, where the ore from its Kentucky mines and most of that purchased are prepared for the market. Shipments from the mill of the company in Kentucky were 30 per cent less in 1929 than in 1928. About one-fourth of the total shipped in 1929 was acid-grade fluorspar.

At the Watson (or Liberty Bond) mine, 7 miles southwest of Marion, mining was conducted on an increased scale, 42 per cent more fluorspar being mined in 1929 than in 1928. The concentrating equipment at the mine consists of a crusher, a log washer, conveyors, jigs, and tables, and the product recovered from the crude ore treated is of high grade and suitable for use in the manufacture of both ceramics and chemicals. Most of the product recovered in 1929 was of grinding grade; as the milling equipment does not include a grinding unit the product was sold to local mills. However, considerable acid-grade fluorspar was shipped to manufacturers of hydrofluoric acid.

At the Lucile mine, a short distance south of the railroad station at Marion, the production and sales of fluorspar were considerably less in 1929 than in 1928.

Production of crude ore from the mines of the Lafayette Fluorspar Co. near Mexico, Ky., was about 5 per cent more in 1929 than in 1928. The quantity of crude ore treated in the mill, however, was 31 per cent more than in 1928, and shipments of concentrates were 11 per cent greater than in 1928. All the fluorspar shipped from these mines in 1929 was of fluxing grade and went to steel plants. Throughout 1929 development and mining progressed on and above the 250-foot level in the Tabb No. 1 mine, and deepening of the Tabb No. 1 shaft to the 400-foot level was started. Extension of the 250-foot level eastward to an unmined ore body was in progress at the end of 1929. The 250-foot level of the Tabb No. 1 mine and the 200-foot level of the Wheatcroft mine were connected, and in future all ore from the Wheatcroft mine will be hoisted through the Tabb No. 1 shaft; consequently, the surface plant at the Wheatcroft mine was abandoned. Tabb No. 2 mine was operated during January and February of 1929; it was then allowed to fill with water, and all operations were concentrated at Tabb No. 1 and Wheatcroft mines for operating economy. However, a considerable tonnage still remains in Tabb No. 2 mine. All labor employed at the mines is native white, was steadily employed throughout the year without labor trouble, and made an exceptionally favorable safety record.

The Crystal mine, 10 miles from Marion, yielded 2,000 short tons of run-of-mine fluorspar, from which was recovered by log washing 1,257 tons of gravel fluorspar which was sold to mills at Marion.

The Kentucky Fluor Spar Co., which has a mill a short distance south of the station at Marion and adjoining the Lucile mine, did 5 per cent less business by volume than in 1928; fluxing grades comprised 40 per cent, ground fluorspar 53 per cent, and tailings 7 per cent of the sales in 1929. This company does not operate any mines, but buys part or all of the output of many local mines and prospects. In 1929 the company obtained its supply chiefly from the Blue & Marble, Lucile, Davenport, Crystal, Watson, Guill, and Nancy Hanks mines.

Operations at the Blue & Marble mine, 1 mile south of Mexico, Ky., were on an enlarged scale in 1929; more than 4,000 short tons of washed fluorspar was recovered, most of which was sold to mills at Marion.

The Pigmy mine, three-fourths of a mile south of the railroad station at Mexico, Ky., was worked about three months in 1929; a considerable tonnage of ore was developed, a small part of which was extracted during current operations. The ore mined in 1929 was log-washed at the mine, and the greater part of it was shipped to the Franklin mill at Marion to be remilled for the production of acid-grade fluorspar.

The Holly mine, 10 miles west of Marion, nonproductive in 1928, was operated about four months in 1929; 2,925 short tons of fluorspar. was recovered, most of which was sold to the Franklin mill at Marion.

In 1929, as in 1928 and 1927, the entire output of the Davenport mine, 8 miles from Marion, was sold to local mills. The output amounted to 2,000 short tons of crude ore, from which 1,247 tons of log-washed fluorspar was recovered.

On the property of the Pope Mining Co., 4 to 6 miles from Marion, prospecting was in progress during 1929; two shafts were sunk, one to a depth of 90 feet and the other 60 feet, from each of which levels were run. Some fluorspar was mined from these shafts in 1929 and was sold to local mills. The company's Two Brothers mine, 10 miles southwest of Marion, was not operated in 1929, but 200 tons of fluorspar was recovered from an old dump and sold to local mills.

At the Keystone mine, 5 miles west of Marion, development which was started in 1928 was continued during 1929; the work consisted chiefly of sinking a shaft and erecting a building in which to house the equipment necessary for mining operations. In the course of development in 1929 about 1,000 tons of ore was mined, about half of which was shipped to the company's mill at Rosiclare, Ill., where it was prepared for the market.

Considerable prospecting and developing were done in Crittenden County in 1929, and some mines and prospects that have been closed for some time were being reopened and some new prospects were being developed. Such properties include the Reiter, Edwards, Butler, Sullinger, Crittenden Springs, Ben Belt, Pepper Box, Peyton, Liberty, and Crosson Cave. From each of these properties ore, in quantities ranging from a few tons to 300 tons, was mined in 1929.

Livingston County.—In Livingston County 6 mines were worked in 1929; they produced about 19,700 short tons of crude fluorspar, as compared with about 16,000 tons produced by 4 mines in 1928.

The chief producer in the county in 1929 was the Klondike mine, 6 miles southwest of Salem and 7 miles northeast of Smithland. This mine, reopened in 1928 after several years of inactivity, produced 15,000 short tons of run-of-mine ore in 1929, from which was recovered 8,274 tons of gravel fluorspar of fluxing grade.

The Guill mine, 1½ miles north of Salem, was worked on a considerably smaller scale in 1929 than in 1928. The ore from this mine is log washed, the resultant product being a high-grade fluorspar. Some of the output was shipped to manufacturers of hydrofluoric acid, but most of it was sold to local mills for further milling to a product suitable for use in the ceramic and chemical industries.

The Nancy Hanks mine, 1½ miles southeast of Salem and 13 miles southwest of Marion, produced somewhat less fluorspar in 1929 than in 1928; all of it was sold to the mills at Marion.

At the Loveless prospect, 13 miles southwest of Marion, where development was started in 1928, a little fluorspar was mined during the early part of 1929. The lease was surrendered on June 20.

At the Riley mine, 10 miles southwest of Marion and 4 miles southeast of Salem, a small quantity of fluorspar was mined in 1929; all of it was sold to the Franklin mill.

A little fluorspar was mined at the Green mine near Salem and sold to local mills.

The list that follows contains the names and addresses of the chief operators of fluorspar mines and mills in Kentucky.

Operators of chief fluorspar mines or mills in Kentucky

Crook Corporation, S. L	Princeton, Ky.
Eagle Fluor Spar Co	Salem, Ky.
Franklin Fluorspar Co	Paducah, Ky.
Fredonia Fluorspar Co	Princeton, Ky.
Gugenheim Mining Co	Marion, Ky.
Haynes, W. V	Do.
Hillside Fluor Spar Mines	Chicago, Ill.
Holly Fluorspar Co	Marion, Ky.
Independent Fluorspar Co	Do.
Kentucky Fluor Spar Co	Do.
Klondike Fluorspar Corporation	Mullikin, Ky.
Lafayette Fluorspar Co	Duluth, Minn.
Lynch, R. A	Marion, Ky.
McMaster & Hunter	Mexico, Ky.
Oglebay Norton & Co	Cleveland, Ohio.
Pope Mining Co	Louisville, Ky.
Zinc & Spar Co	Salem, Ky.

NEVADA

The Daisy mine, 4½ miles southeast of Beatty in Nye County, was worked continuously in 1929, and 757 short tons of run-of-mine fluorspar of gravel size was produced and shipped to steel plants on the Pacific coast.

At the Baxter mine, 5½ miles from Broken Hills in Mineral County, a shaft was sunk 100 feet, from which about 150 feet of drifting was done; in addition, about 300 feet of surface drifting was completed. About 700 tons of fluorspar was produced at this property in 1929, of which 600 tons was shipped. The product shipped in 1929 is reported to have averaged about 94 per cent of calcium fluoride; two carloads that were shipped to a manufacturer of hydrofluoric acid are said to have contained 99 per cent of calcium fluoride. A serious handicap to large-scale production, however, is the distance of about 75 miles to Fallon, the railroad shipping point.

Producers of fluorspar in Nevada in 1929

Crowell, J. Irving, jr	Beatty, Nev.
Fluorite Producers	Stockton, Calif.

NEW MEXICO

Shipments of fluorspar from New Mexico in 1929 aggregated 2,438 short tons, slightly less than the 2,589 tons shipped in 1928. Of the 1929 total, 2,295 tons was for use in steel plants and the remainder (143 tons) for use in foundries.

The greater part of the fluorspar mined in New Mexico in 1929 was obtained from Dona Ana County, near Las Cruces. The ore was hauled to the Tortugas mill near Mesilla Park, where it was prepared for the market. Practically all of the fluorspar from this mill in 1929 was shipped for use in steel plants.

A carload of lump fluorspar was shipped from the Heathden mine in Dona Ana County, 1 mile from Heathden.

In Grant County near Cliff the Rain Creek mine was opened in 1929, and 210 tons of crude ore was mined. The ore was hand sorted and crushed to gravel size; it yielded 189 tons of marketable fluorspar, which was hauled 50 miles to Silver City, the railroad shipping point, and shipped to the steel plant at Pueblo, Colo. This distance, however, proved too great a handicap for profitable operation, and the mine was closed in September.

Production was started in 1929 at the newly opened Humbolt mine near Hot Springs in Sierra County, and several carloads of fluorspar were shipped to the steel plant at Pueblo.

The Hot Springs mine, 4½ miles south of Hot Springs, Sierra County, which has been one of the important producers of ground fluorspar in the West, was inactive the entire year 1929.

At a property in Luna County 8 miles north of Nutt, several carloads of fluorspar were mined and shipped in 1929. Most of the fluorspar was shipped to the steel plant at Pueblo, but two carloads were shipped to a foundry and two carloads were shipped to the mill at Mesilla Park to be prepared for shipment to consumers.

Producers of fluorspar in New Mexico in 1929 were as follows:

Producers of fluorspar in New Mexico in 1929

Brazeal, J. E	Rincon, N. Mex.
Hayner & Manasse	Las Cruces, N. Mex.
Ryan & Armstrong	Silver City, N. Mex.
Velie Metals Co	Hot Springs, N. Mex.

STOCKS AT MINES OR SHIPPING POINTS

According to the reports of producers the total quantity of fluorspar in stock at the mines or at shipping points at the close of 1929 was 73,901 short tons, an increase of 2 per cent over 1928. These stocks consisted of 55,773 tons of crude fluorspar calculated to be equivalent to 31,000 tons of ready-to-ship fluorspar and of 18,128 tons of ready-to-ship fluorspar. As the quantity of fluorspar in stock piles must be partly estimated, the mine reports vary from year to year, preventing an absolute balance between the quantity mined and that shipped and in stock.

Stocks of fluorspar at mines or shipping points in the United States, 1928 and 1929, by States, in short tons

State	1928			1929		
	Crude [1]	Ready-to-ship	Total	Crude [1]	Ready-to-ship	Total
Arizona	150	225	375	150	225	375
Colorado	295	56	351	265	40	305
Illinois	7, 322	8, 278	15, 600	6, 945	12, 540	19, 485
Kentucky	51, 461	3, 473	54, 934	47, 205	5, 143	52, 348
Nevada	80	----------	80	60	100	160
New Mexico	1, 100	130	1, 230	1, 100	80	1, 180
Texas	48	----------	48	48	----------	48
	60, 456	12, 162	72, 618	55, 773	18, 128	73, 901

[1] The greater part of this crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.

IMPORTS AND EXPORTS [4]

The total imports of fluorspar into the United States in 1929 amounted to 54,345 short tons, valued [5] at $480,975, and are the third largest ever recorded. The imports in 1929 consisted of 30,148 tons containing more than 93 per cent of calcium fluoride and 24,197 tons containing not more than 93 per cent of calcium fluoride. The imports in 1929 increased 15 per cent in quantity and 18 per cent in total value over 1928. The value assigned to the foreign fluorspar averaged $8.85 a ton. The cost to consumers in the United States includes, in addition, the duty, loading charges at the docks, the ocean freight, and other charges, besides the freight from docks to manufacturers' plants.

The imports were equivalent to 37 per cent of the total shipments of domestic fluorspar in 1929, as compared with 34 per cent in 1928.

Complete information is not available as to the uses for which foreign fluorspar was imported, but reports furnished by importers and covering 74 per cent of the total imports in 1929, together with other information, indicate the following distribution.

Uses for which foreign fluorspar was imported in 1929

	Short tons
Steel and iron	39, 336
Glass and enamel	3, 691
Hydrofluoric acid	6, 634
Unknown	4, 684
	54, 345

As shown in the foregoing statement and as is well known in the industry, the greater part of the imported fluorspar is of fluxing grade and is used in the steel industry. According to reports of the importers of 33,567 short tons of the imported fluorspar sold to steel manufacturers in 1929, the selling price of this quantity at tidewater, duty paid, ranged from $14 to $19 a short ton and averaged about $17.90 a short ton.

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[4] Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce; those on exports supplied by the producers. No exports of fluorspar recorded by the Bureau of Foreign and Domestic Commerce.

[5] "The value of imported merchandise * * * is the foreign value or the export value, whichever is higher—that is, the market value or the price at which the merchandise, at the time of exportation to the United States, is offered for sale in the principal markets of the country from which exported, including the cost of containers or coverings and all expenses (including any export tax) incident to placing the merchandise in condition ready for shipment to the United States, as defined in section 402 of the tariff act of 1922."

The selling price of imported ground fluorspar, which was sold to manufacturers of glass and enamel, ranged from $23.50 to $44 a short ton and averaged about $35.85 a short ton.

The United Kingdom, which from 1922 to 1926 was the chief source of imported fluorspar, supplied only 9 per cent of the total imported in 1929. The imports from the United Kingdom in 1929 were only slightly more than half those in 1928, and were all of the class containing not more than 93 per cent of calcium fluoride.

France was the chief source of imported fluorspar in 1929, supplying 16,850 short tons, of which 11,915 tons contained not more than 93 per cent of calcium fluoride and the remainder (4,935 tons) contained more than 93 per cent of calcium fluoride.

The imports from Germany in 1929, amounting to 16,488 short tons, were 6 per cent less than those in 1928. Of the total, 15,022 tons contained more than 93 per cent of calcium fluoride. The greater part of the fluorspar imported from Germany in 1929, however, was sold for use as a flux in basic open-hearth steel plants. Germany was the chief source of imported ground fluorspar in 1929; some acid-grade fluorspar was also imported in 1929.

The imports of fluorspar from Italy in 1929, amounting to 1,258 short tons, were 22 per cent greater than those in 1928. Practically all the fluorspar imported from Italy in 1929 contained more than 93 per cent of calcium fluoride, was ground, and was sold to manufacturers of glass and enamel.

The imports of fluorspar from Spain in 1929, amounting to 7,168 short tons, showed a large increase over the 680 tons imported in 1928. Of the 7,168 tons imported from Spain in 1929, 5,901 tons contained not more than 93 per cent of calcium fluoride and 1,267 tons contained more than 93 per cent of calcium fluoride. Practically the entire importation from this source, however, was sold for use in basic open-hearth steel plants.

Africa has been the chief source of imported acid-grade fluorspar since 1923; the imports from this source were 6,387 short tons in 1929 as compared with 2,661 tons in 1928. Most of the fluorspar imported from Africa is mined in the Union of South Africa; during recent years, however, deposits of fluorspar have been opened in the Southwest African Protectorate, and some fluorspar from this source has been imported into the United States.

The imports of fluorspar from China in 1929, although small, were substantially larger than those in 1928. The fluorspar imported from this source in 1929 was all of the class containing more than 93 per cent of calcium fluoride, and most of it was sold to steel manufacturers on the Pacific coast.

The rate of duty on fluorspar that contains not more than 93 per cent of calcium fluoride was increased, effective November 16, 1928, from $5.60 per long ton ($5 per short ton) to $8.40 per long ton ($7.50 per short ton). The rate of duty on fluorspar that contains more than 93 per cent of calcium fluoride remains $5 per short ton.

The distances that domestic fluorspar must be transported by rail from mines to steel plants in the Lehigh and Susquehanna Valleys of Pennsylvania are much greater than the distances that foreign fluorspar must be moved from the ports of entry to these plants, so that comparatively little domestic fluorspar is sold to steel plants in this area. Moreover, a large part of the imported material is carried as ballast, making possible a lower market price than would have to be charged if it were carried as a primary cargo. However, as the value of fluorspar depends mainly upon its purity, comparison of American with foreign fluorspar should be made not merely on the basis of price per ton but on quality as well.

Fluorspar imported into the United States, 1928 and 1929, by countries

[General imports]

Country	1928			1929		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Africa: British—						
South	2,661	$36,471	$13.71	5,106	$59,014	$11.56
Other				1,281	16,842	13.15
Argentina	20	360	18.00			
Belgium				21	519	24.71
China	756	8,200	10.85	1,345	11,534	8.58
France	15,072	141,434	9.38	16,850	159,059	9.44
Germany	17,601	150,872	8.57	16,488	140,860	8.54
Italy	1,033	9,600	9.29	1,258	10,528	8.37
Spain	680	5,178	7.61	7,168	52,039	7.26
United Kingdom	9,360	56,585	6.05	4,828	30,580	6.33
	47,183	408,700	8.66	54,345	480,975	8.85

Fluorspar imported into the United States in 1929, by countries and districts

[General imports]

Country	District	Containing more than 93 per cent of calcium fluoride		Containing not more than 93 per cent of calcium fluoride	
		Short tons	Value	Short tons	Value
Africa: British—					
South	Maryland	553	$6,412		
	Philadelphia	4,553	52,602		
		5,106	59,014		
Other	do	1,281	16,842		
Belgium	Los Angeles	21	519		
China	do	56	442		
	New York	1	23		
	San Francisco	896	7,276		
	Washington	392	3,793		
		1,345	11,534		
France	Buffalo	567	5,954	4,166	$39,013
	Maryland	482	5,142		
	New York	560	5,153	99	739
	Philadelphia	3,326	33,032	7,650	70,026
		4,935	49,281	11,915	109,778
Germany	Los Angeles	34	865		
	Maryland	13,742	117,294	1,466	8,442
	Massachusetts	304	1,688		
	New York	68	1,666		
	Ohio	22	620		
	Philadelphia	765	8,308		
	San Francisco	87	1,977		
		15,022	132,418	1,466	8,442
Italy	Maryland	87	884		
	Philadelphia	1,084	8,929	87	715
		1,171	9,813	87	715
Spain	Buffalo	325	3,371	890	8,101
	New York	128	1,189	848	5,176
	Philadelphia	814	7,949	4,163	26,253
		1,267	12,509	5,901	39,530
United Kingdom	Maryland			1,084	4,866
	Philadelphia			3,744	25,714
				4,828	30,580
		30,148	291,930	24,197	189,045

Fluorspar imported into the United States, 1920–1929, by countries

[General imports]

Year	Africa		Canada		France		Germany		Italy	
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Average value
1920	30	$36.00	7,068	$15.64	--------	----------	407	$23.22	--------	----------
1921	--------	----------	4,370	12.09	--------	----------	215	20.56	--------	----------
1922	486	17.31	2,877	11.36	--------	----------	5,804	8.48	--------	----------
1923	10,380	15.19	(1)	----------	--------	----------	8,580	7.88	268	$9.22
1924	11,125	13.30	213	15.10	232	$11.99	6,834	10.15	1,585	9.34
1925	7,906	13.74	--------	----------	2,537	8.23	11,680	8.89	4,278	7.53
1926	8,506	16.05	1,109	9.30	11,163	8.13	20,465	8.39	1,379	11.19
1927	7,069	12.87	560	7.59	11,711	7.37	31,829	7.25	449	13.29
1928	2,661	13.71	--------	----------	15,072	9.38	17,601	8.57	1,033	9.29
1929	6,387	11.88	--------	----------	16,850	9.44	16,488	8.54	1,258	8.37

Year	Spain		United Kingdom		All other		Total		
	Short tons	Average value	Short tons	Average value	Short tons	Average value	Short tons	Value	
								Total	Average
1920	--------	----------	17,096	$8.43	11	$38.73	24,612	$265,630	$10.79
1921	--------	----------	1,644	7.32	--------	----------	6,229	69,306	11.13
1922	--------	----------	23,836	8.68	105	18.55	33,108	299,188	9.04
1923	--------	----------	22,862	8.86	136	15.26	42,226	432,319	10.24
1924	--------	----------	29,365	10.16	1,689	11.32	51,043	555,642	10.89
1925	--------	----------	21,635	9.02	664	12.09	48,700	468,847	9.63
1926	2,948	$11.50	29,407	9.58	694	9.85	75,671	747,237	9.87
1927	978	3.73	18,449	9.15	470	9.38	71,515	595,185	8.32
1928	680	7.61	9,360	6.05	776	11.03	47,183	408,700	8.66
1929	7,168	7.26	4,828	6.33	1,366	8.82	54,345	480,975	8.85

[1] Quantity not recorded; total value, $5.

Producers of fluorspar reported exports in 1929 amounting to 506 short tons, valued at $11,621, or $22.97 a ton, as compared with 398 tons, valued at $6,586, or $16.55 a ton, in 1928. All the fluorspar exported in 1928 and 1929 went to Canada.

Fluorspar reported by producers as exported from the United States, 1920–1929

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1920	2,764	$65,475	$23.69	1925	1,055	$17,574	$16.66
1921	--------	----------	----------	1926	2,132	34,915	16.38
1922	2,296	40,966	17.84	1927	385	7,507	19.50
1923	1,144	25,312	22.13	1928	398	6,586	16.55
1924	617	14,489	23.48	1929	506	11,621	22.97

USES

The uses of and specifications for fluorspar are discussed in greater detail in Mineral Resources, 1926, Part II, pages 30 to 34.

Metallurgical industries.—Fluorspar has many uses, but the most important is in the manufacture of steel by the basic open-hearth process. It is also used in the manufacture of alloy steel and ferroalloys by the electric furnace process and in some foundry and other metallurgical operations.

Ceramic industries.—Fluorspar is used in considerable quantities in the glass industry, chiefly for the manufacture of opal or opaque and colored glass; as an ingredient in enamels for various purposes; and in the manufacture of cement, in which it is said that the addition of fluorspar to the raw materials permits the lowering of the fusing point, resulting in considerable economy in fuel, as well as economy in power, because the clinker obtained is fragile and therefore more easily ground.

Chemical industries.—Fluorspar is the basic material used in the manufacture of hydrofluoric acid. It is also said to be used to facilitate the fusion and contact of ingredients in the manufacture of calcium carbide and cyanamid.

Optical fluorspar.—A very small quantity of clear fluorspar crystals is used for optical purposes; fluorspar is useful in correcting the color and spherical aberration errors in lenses, especially those of microscopes and small telescopes.

CONSUMPTION—STOCKS AT CONSUMERS' PLANTS

Figures on the consumption of fluorspar in 1928 and 1929 and on stocks at consumers' plants at the close of these years are given in the following table. Although these figures do not include data from all consumers they are believed not to fall far short of the total for the United States. Thus, the figures for the basic open-hearth steel industry, the chief consumer of fluorspar, include actual figures from the 68 companies that make 99 per cent of the total basic open-hearth steel and estimates for the other 3 companies. Consumption by all the electric steel and ferro-alloy manufacturers who are known to use fluorspar is represented. The smaller foundries, some of which use a little fluorspar, are not all represented, so that data on the consumption and stocks for this industry are somewhat incomplete. The figures for fluorspar used in hydrofluoric acid for the two years represent actual figures for five companies and an estimate for one company. The consumption and stocks for the glass and enamel industries, although not representing all the consumers, do represent 111 companies and are believed to be practically complete, as these companies include all the larger and probably most of the smaller consumers.

Fluorspar consumed and in stock in the United States, 1928 and 1929, by industries, in short tons

Industry	1928		1929	
	Consumption	Stocks at consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31
Basic open-hearth steel	152, 000	76, 000	157, 000	71, 200
Electric-furnace steel	6, 100	1, 300	6, 500	1, 100
Foundry	3, 300	1, 000	2, 700	700
Ferro-alloys	800	400	1, 100	200
Hydrofluoric acid and derivatives	20, 500	11, 000	15, 600	14, 000
Enamel and vitrolite	5, 700	900	5, 200	700
Glass	6, 200	1, 200	6, 600	1, 000
Miscellaneous	1, 600	600	1, 500	600
	196, 200	92, 400	196, 200	89, 500

The average quantity of fluorspar used by individual plants per ton of basic open-hearth steel made varies widely, usually ranging from 1 to 50 pounds. In general, the average is between 6½ and 8 pounds—a very small proportion of the furnace charge. The next table shows over a period of five years the variation in average consumption of fluorspar per ton of basic open-hearth steel in certain plants that make about 81 per cent of the total.

Average consumption of fluorspar per ton of steel, 1925–1929, in pounds

1925	1926	1927	1928	1929
13.983	12.959	13.315	12.211	14.727
7.893	8.219	7.074	6.761	6.043
6.224	5.700	6.100	5.640	4.825
4.809	6.270	7.067	6.253	6.674
4.568	4.313	4.862	4.181	3.815
8.656	8.541	8.572	8.204	7.215
4.992	4.862	4.561	5.875	6.237
7.037	5.523	4.225	4.726	5.173
5.719	6.692	6.320	7.648	7.344
5.551	4.289	4.487	6.156	5.822
15.007	8.440	11.509	10.766	10.470
8.057	8.638	7.463	6.215	6.287
2.469	4.348	10.033	6.953	5.569
12.903	13.103	12.850	12.261	11.510

The table that follows shows the relation of the consumption of fluorspar to the production of basic open-hearth steel for the five years from 1925 to 1929 and the stocks of fluorspar at such plants at the close of each of these years.

Consumption and stocks of fluorspar at basic open-hearth steel plants, 1925–1929

	1925	1926	1927	1928	1929
Production of basic open-hearth steel ....long tons..	37,087,342	39,653,315	37,144,268	43,200,483	[1]47,657,000
Consumption of fluorspar in basic open-hearth steel production......short tons..	137,700	142,000	138,000	152,000	157,000
Consumption of fluorspar per ton of steel made........pounds..	7.4	7.2	7.4	7.0	6.6
Stocks of fluorspar on hand at steel plants at end of year........short tons..	49,400	70,000	85,000	76,000	71,200

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[1] Partly estimated.

CONSUMERS

A directory of consumers of fluorspar in the United States, classified according to the industries in which the mineral is used and each industry arranged alphabetically by States and by location of consuming plant, is given in Mineral Resources, 1926, Part II, pages 38 to 45. The marketing of and markets for fluorspar are discussed in Mineral Resources, 1926, Part II, pages 35 to 38.

WORLD PRODUCTION

The following table was compiled by the Bureau of Mines from official sources as far as possible.

World production of fluorspar, 1925–1929, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Argentina [1]			24		(2)
Australia:					
New South Wales					96
Queensland	4,295	2,348	1,050	1,143	(2)
Canada	3,525				16,211
Chosen				4	(2)
France	24,430	41,670	(2)	(2)	(2)
Germany: [3]					
Bavaria	31,454	32,475	51,001	48,552	(2)
Prussia	24,101	29,729	36,607	37,365	(2)
Saxony	16,141	17,442	22,027	16,422	(2)
Great Britain	39,706	36,459	40,362	47,614	(2)
Italy	7,770	6,320	5,577	4,420	5,490
Mexico		937	(2)	(2)	(2)
Norway [4]	5		(5)		(2)
Russia [6]	1,211	3,765	840	(2)	(2)
Southwest African Protectorate	(2)	(2)	995	872	(2)
Spain	2,436	14,011	757	2,082	(2)
Union of South Africa	4,883	8,403	7,582	5,582	(2)
United States	103,118	116,715	102,099	127,450	132,847

[1] Railroad shipments.
[2] Data not available.
[3] In addition to the German States listed, fluorspar is produced in Baden and Thuringia, but data of output are not available.
[4] Exports.
[5] Less than 1 ton (500 kilograms).
[6] Data for year ended Sept. 30.

CANADA [6]

In 1929 the production of fluorspar in Canada amounted to 17,870 short tons, valued at $46,648. Of this output 17,800 tons was contributed by the Rock Candy mine in British Columbia, and 70 tons was mined in Ontario near Madoc. There was no production of fluorspar in Canada in 1926, 1927, and 1928.

Imports of fluorspar into Canada in 1929 amounted to 12,092 short tons, valued at $159,798, as compared with 14,362 tons, valued at $153,046, in 1928.

CRYOLITE

Cryolite occurs in commercial quantities and is mined at only one place—Ivigtut, Greenland. The greater part of the product is shipped to Copenhagen, and the remainder is exported to the United States, from which some is reexported to Canada. Of the cryolite shipped to the United States the greater part is used in the metallurgy of aluminum and in making opaque glass.

An article on the cryolite mine at Ivigtut was published in 1926 by Gordon.[7] He discusses the discovery, exploitation, and mining of cryolite and describes the geology and mineralogy of the deposit.

According to the Bureau of Foreign and Domestic Commerce, the imports of cryolite into the United States in 1929 amounted to 7,778 long tons, valued at $670,841, or $86.25 a ton, compared with 6,906 long tons, valued at $529,176, or $76.63 a ton, imported in 1928.

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[6] Dominion Bureau Statistics, Preliminary Report of the Mineral Production of Canada during the Calendar Year 1929: Ottawa, 1930.

[7] Gordon, S. G., Mining Cryolite in Greenland: Eng. and Min. Jour.-Press, vol. 121, Feb. 6, 1926, pp. 236–240.

FUEL BRIQUETS[1]

By O. E. Kiessling and J. M. Corse

PRODUCTION

In 1929, for the first time in the history of the industry, the production of fuel briquets exceeded 1,000,000 tons. According to reports courteously furnished the Bureau of Mines by the operators of briquetting plants, the total output in 1929 was 1,212,415 net tons, valued at $9,515,205. This represents an increase of 28 per cent in tonnage and 23.5 per cent in value over 1928. It is also a gain of 21.8 per cent in tonnage and 11.5 per cent in value over the previous records, established in 1926. Production in the month of December, 1929, which amounted to 175,960 tons, reached a new monthly maximum, exceeding by 27,130 tons the record monthly output for preceding years, established in 1927.

The sharp increase in the output in 1929, at a time when supplies of anthracite and bituminous coal were ample, is a definite indication of the expanding market for briquets.

Fuel briquets produced in the United States, 1928 and 1929

	Production			Value		
	1928	1929	Increase or decrease	1928	1929	Increase or decrease
	Net tons	*Net tons*	*Per cent*			*Per cent*
Eastern States	228,767	324,967	+42.1	$1,496,211	$2,030,837	+35.7
Central States	605,725	788,160	+30.1	5,077,686	6,409,755	+26.2
Pacific Coast States	112,931	99,288	−12.1	1,131,720	1,074,613	−5.0
	947,423	1,212,415	+28.0	7,705,617	9,515,205	+23.5

In 1929 the Eastern States showed the greatest proportionate increase in production of briquets—the output was 324,967 tons, or 42.1 per cent more than in 1928 and 12.5 per cent above the previous record tonnage, that in 1926. The Central States reported an increase of 30.1 per cent over 1928 and a gain of 25.1 per cent over the previous record set in 1927. In fact, the 1929 output of 788,160 tons in the Central States alone is considerably greater than the production of the entire country in any year prior to 1925. Offsetting in a small measure the gains in other areas, production in the Pacific Coast States declined to 99,288 tons in 1929, from 112,931 tons in 1928 and 143,676 tons in 1927.

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[1] Work on manuscript completed April, 1930.

Wisconsin in 1929 accounted for more than half of the total output. Its three plants combined with the five plants active in Pennsylvania produced more than 73 per cent of the total tonnage for the country.

The expansion of the industry in recent years has been particularly notable in the Central States. For the country as a whole the production of briquets has more than doubled in the decade 1920–1929. During this period the use of briquets was stimulated by the anthracite shortages of 1920, 1922–23, and 1925–26. The curve in Figure 1 shows the trend of production during the last 15 years.

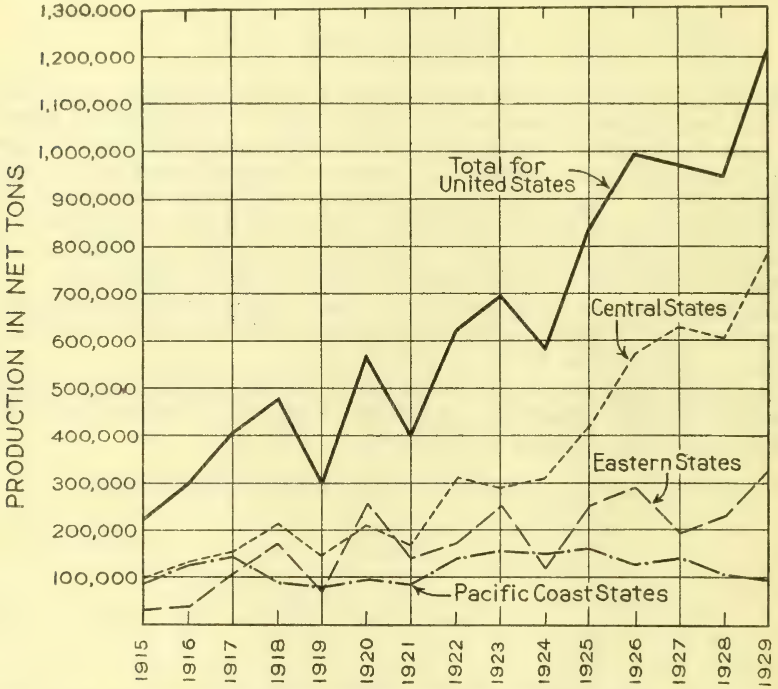

FIGURE 1.—Fuel briquets produced in the Eastern, Central, and Pacific Coast States and in the United States, 1915–1929

The progress of the industry since 1907, the date of the first statistical survey covering fuel briquets, is recorded in the following table.

Fuel briquets produced in the United States, 1907–1929 [1]

Year	Net tons	Value	Year	Net tons	Value
1907	66, 524	$258, 426	1919	295, 734	$2, 301, 054
1908	90, 358	323, 057	1920	567, 192	4, 623, 831
1909	139, 661	452, 697	1921	398, 949	3, 632, 301
1910	(2)	(2)	1922	619, 425	5, 444, 926
1911	218, 443	808, 721	1923	696, 810	5, 898, 698
1912	220, 064	952, 261	1924	580, 470	4, 986, 622
1913	181, 859	1, 007, 327	1925	839, 370	7, 128, 404
1914	250, 635	1, 154, 678	1926	995, 332	8, 533, 179
1915	221, 537	1, 035, 716	1927	970, 468	7, 985, 165
1916	295, 155	1, 445, 662	1928	947, 423	7, 705, 617
1917	406, 856	2, 233, 888	1929	1, 212, 415	9, 515, 205
1918	477, 235	3, 212, 793			

[1] Figures for earlier years not available.

[2] No canvass for 1910.

MONTHLY PRODUCTION

In three months of 1929—January, November, and December—the production of briquets exceeded the previous monthly maximum of 148,830 tons, established in December, 1927. As already noted, output in December, 1929, set a new record.

The seasonal character of househeating makes the production of briquets highly seasonal. Activity, therefore, is curtailed and at many plants discontinued during the early spring and summer. In 1929 July marked the lowest ebb of output; January and February and the last three months of the year were the periods of greatest production.

Monthly production of fuel briquets in the United States, 1924–1929, in net tons

Month	1924	1925	1926	1927	1928	1929
January	80, 938	93, 310	125, 721	123, 239	119, 846	159, 768
February	42, 609	62, 479	110, 815	79, 227	91, 162	139, 540
March	24, 953	47, 504	66, 811	37, 557	56, 386	44, 266
April	20, 183	26, 498	35, 281	28, 067	39, 547	42, 952
May	17, 795	26, 350	31, 943	42, 243	91, 433	112, 418
June	16, 017	28, 183	32, 870	52, 927	43, 514	44, 582
July	25, 611	42, 224	40, 877	28, 692	30, 335	36, 300
August	40, 743	63, 161	57, 603	72, 577	52, 658	57, 439
September	65, 745	79, 118	80, 066	99, 261	69, 255	96, 948
October	74, 873	118, 543	134, 543	131, 699	111, 736	145, 156
November	80, 936	123, 316	140, 655	126, 149	119, 394	157, 086
December	90, 067	128, 684	138, 147	148, 830	122, 157	175, 960
	580, 470	839, 370	995, 332	970, 468	947, 423	1, 212, 415

PRODUCERS' STOCKS OF FINISHED BRIQUETS

For 1929, as for 1928, the Bureau of Mines requested information on the quantity of finished briquets on hand in producers' yards on various dates in the year. The replies show that on January 1, 1929, producers had on hand 14,407 tons, in comparison with 15,674 tons at the end of the year, indicating a net increase of 1,267 tons in stocks during the year.

As compared with the seasonal character of requirements and output, producers' stocks show little variation. For any date of record in the past two years they have never been more than 1.5 per cent or less than 1.1 per cent of the 1929 total output. Obviously, the sharp demand during the fall and winter is met by rapidly expanded production rather than by drawing upon accumulated producers' stocks.

Producers' stocks of finished briquets in 1929, in net tons

Jan. 1, 1929	14, 407
July 1, 1929	15, 508
Oct. 1, 1929	13, 730
Jan. 1, 1930	15, 674

VALUE

The total value of the briquets manufactured during 1929 was $9,515,205, an increase of $1,809,588, or 23.5 per cent, when compared with 1928. The average value per net ton f. o. b. plant in 1929 was $7.85, as compared with $8.13 in 1928 and $8.23 in 1927. The drop in the average value per ton in 1929 is in part a reflection of lower price trends for almost all solid fuels and is in part due to the increased output of the relatively low-priced product of the Eastern States.

The sales realizations obtained on briquets in the scattered producing centers in a given year show considerable variations. For this reason the figure on average value per ton for the entire industry is of doubtful significance because of the different conditions under which briquets are manufactured in certain sections of the country. Among the factors that influence the value per ton at any plant, the most important are probably the cost of raw materials and the prices of competing fuels. Hence the trend of prices from year to year is best indicated by the average value in particular localities, as shown by the following table.

Average value per net ton (f. o. b. plant) of briquets produced in Pennsylvania and in the Central States, 1911–1929

Year	Pennsylvania	Central States	Year	Pennsylvania	Central States
1911	$2.37	$4.34	1921	$6.14	$9.28
1912	2.68	4.47	1922	5.93	9.02
1913	2.65	4.92	1923	5.95	9.35
1914	2.48	4.83	1924	5.82	9.00
1915	2.90	4.26	1925	6.35	8.72
1916	3.83	4.73	1926	6.74	8.86
1917	3.15	6.81	1927	6.52	8.30
1918	4.11	8.17	1928	6.38	8.38
1919	4.17	8.47	1929	6.22	8.13
1920	5.60	9.23			

For the Eastern States the average value per ton f. o. b. plant in 1929 was $6.25, as compared with $6.54 in 1928. The average for the State of Pennsylvania in 1929 was $6.22, a decrease of 16 cents from 1928 and the lowest figure since 1924. In the eastern part of the country materials suitable for the manufacture of briquets are available at relatively low cost and competition with other fuels is especially keen. The average value per ton for the Pacific Coast States was $10.82 in 1929, a gain of 80 cents over 1928. The average value of the product of the Central States was $8.13, a decline of 25 cents from 1928 and the lowest average since 1917.

These figures do not indicate the prices paid by consumers. Some of the plants are long distances from the markets where their product is consumed, and to the value at the plant must be added the cost of transportation and the margin of the wholesaler or the retailer and sometimes both.

PRINCIPAL EXPENSES AND VALUE ADDED BY MANUFACTURE

By far the largest item of expense in the manufacture of briquets is the cost of raw materials. A special study covering 1927 indicated that the average cost of raw materials for 16 briquetting plants throughout the country, which produced 93 per cent of the total output, was $5.09 per ton. This compared with expenditures of 17 cents per ton for salaries, 47 cents for wages, and 26 cents for purchased electric power and fuel used for power. The average value of the product in 1927 was $7.86 per ton, and the difference of $1.87 between this figure and the total of principal expenses represented the value added by manufacture. Further details of this analysis are given on page 4 of the report of this series for 1928.

DISTRIBUTION

In its questionnaire for 1929 the Bureau of Mines requested information on the areas of distribution and on the methods of disposing of the briquets. The results of this inquiry, which cover 1,210,483 tons of commercial sales, are given in the following table. It should be noted that the commercial sales were slightly less than the total output, as unmerchantable briquets used for boiler fuel at the plant were excluded and changes in producers' stocks were taken into account.

Commercial sales[1] of fuel briquets in 1929, by areas of distribution and by method of sales, in net tons

	In locality of plant	In other localities	Total[1]	
			Quantity	Per cent of total for which method of sales is reported
Reported by method of sales:				
To wholesalers	2,307	132,283	134,590	14.9
To retailers	70,826	631,459	702,285	77.7
Direct to consumers	66,418	642	67,060	7.4
	139,551	764,384	903,935	100.0
Not reported by method of sales	18,248	288,300	306,548	
Total	157,799	1,052,684	1,210,483	

[1] Total production, less 1,267 tons added to stocks and 665 tons of unmerchantable briquets used by the manufacturer as boiler fuel.

Thirteen per cent of the total sold in 1929—157,799 tons—was distributed in the immediate vicinity of the plants, and the balance—1,052,684 tons—was transported to other localities for consumption. Much of this tonnage was widely distributed, briquets being shipped into no less than 32 States and into Canada. This distribution shows a notable broadening of markets when compared with 1928. (See Fuel Briquets in 1928, fig. 1, p. 5.) Although a considerable proportion of the output at most briquetting operations entered markets outside the States of manufacture, six small plants, with a combined production of less than 1 per cent of the total sales, disposed of their output entirely within the States of origin.

Manufacturers of briquets not only serve markets at considerable distances but they also use several methods in disposing of their product. A study of the questionnaires for 1929 indicates that 2 plants marketed through wholesalers only, 5 sold to retailers only, 4 sold direct to consumers only, and 14 plants used a combination of two or more of the foregoing agencies. As will be seen from the preceding table, producers accounting for 903,935 tons, or three-fourths of the 1929 sales, reported that 14.9 per cent of their output was sold through wholesalers, 77.7 per cent through retailers, and 7.4

per cent was sold direct to consumers. An earlier study, covering 98 per cent of the 1923 output, indicated that 52.3 per cent of the tonnage reported as to method of sale was sold through wholesalers, 32.2 per cent to retailers, and 15.5 per cent to consumers. (See Fuel Briquets in 1923, p. 43.) Although the evidence is not complete, the tendency in the last six years seems to be toward increased selling to retailers with less reliance upon the wholesaler and upon direct-to-consumer sales as methods of disposal.

NUMBER OF PLANTS IN OPERATION

Twenty-five plants reported production of briquets on a commercial scale in 1929, four more than in any other year since the beginning of the statistical record in 1907. In the 23 years from 1907 to 1929 the number of plants has slightly more than doubled as compared with an increase of approximately eightfold in the average annual output per plant. Average production per plant in 1929 was 48,497 tons, a gain over 1928 but somewhat less than the average in the three years 1925 to 1927. The increase in the number of briquetting operations and the notable rise in the average output per plant over an extended period are indicated in the following table.

Number and average production of briquet plants in operation in the United States, 1907–1929

Year	Plants in operation	Average production per plant (net tons)
1907	11	6,048
1908	8	11,295
1909	16	8,729
1910	[1]	[1]
1911	21	10,402
1912	19	11,582
1913	17	10,698
1914	16	15,665
1915	15	14,769
1916	15	19,677
1917	13	31,297
1918	12	39,770
1919	12	24,645
1920	15	37,813
1921	15	26,597
1922	14	44,245
1923	14	49,772
1924	12	48,373
1925	17	49,375
1926	19	52,386
1927	19	51,077
1928	21	45,115
1929	25	48,497

[1] No canvass for 1910.

A list of the 25 plants active in 1929 follows. One plant active in 1928 produced no briquets in 1929, but five new ones began commercial operation during the year—the Lehigh Briquetting Co., at Lehigh, N. Dak.; the Lincoln Power Co., at Howe, Okla.; the American Briquet Co., at Charlestown, Mass.; the Henriette Coal Mining Co., at Dunlo, Pa.; and the Berwind Fuel Co. of West Virginia, at Berwind, W. Va. The Paramount Briquet Co., whose newly erected plant at Seattle, Wash., went into operation in 1929, was successor to the Northwestern Briquetting Co., whose plant at Ravensdale, Wash., was destroyed by fire in 1928.

Briquetting plants operated in the United States in 1929

State	Name and address of operator	Location of plant	Date put in operation	Raw fuel used, as reported by producer
Eastern States:				
Massachusetts	American Briquet Co., 1505 Philadelphia Bank Building, Philadelphia, Pa.	Charlestown	1929	Anthracite and bituminous slack.
Do	Salem Briquette Co., Salem, Mass.	Salem	1927	Anthracite.
New Jersey	Anthracite Manufacturing Co., 500 Brunswick Avenue, Trenton, N. J.	Trenton	1918	Do.
Do	Navicoal Corporation, 1421 Chestnut Street, Philadelphia, Pa.	Keasbey	1925	Anthracite and bituminous slack.
Pennsylvania	American Briquet Co., 1505 Philadelphia Bank Building, Philadelphia, Pa.	Lykens	1920	Anthracite.
Do	Anthracite Briquette Co., Sunbury, Pa.	Sunbury	1919	Do.
Do	Henriette Coal Mining Co., 15 Moore Street, New York, N. Y.	Dunlo	1929	Bituminous slack.
Do	Parlass Coal Co., Forty-seventh Street and Parschall Avenue, Philadelphia, Pa.	Deibler	1928	Anthracite.
Do	Philadelphia & Reading Coal & Iron Co., Twelfth and Market Streets, Philadelphia, Pa.	North Manheim Township.	1927	Do.
Virginia	Delparen Anthracite Briquette Co., Parrott, Va.	Parrott	1915	"Virginia anthracite."
Do	Old Dominion Anthracite Corporation, 1848 Straus Building, Chicago, Ill.	Pulaski	1926	Do.
Do	Virginia Fuel Corporation, P. O. Box 505, Norfolk, Va.	Portlock	1923	Anthracite and bituminous slack.
West Virginia	Berwind Fuel Co. of West Virginia, 122 South Michigan Avenue, Chicago, Ill.	Berwind	1929	Bituminous slack.
Do	West Virginia Super Fuel Co., 712 Park Building, Pittsburgh, Pa.	Moundsville	1927	Semicoke.[1]
Central States:				
Missouri	Standard Briquet Fuel Co., 818 Security Building, St. Louis, Mo.	Kansas City	1909	"Arkansas anthracite and semianthracite slack."
North Dakota	Lehigh Briquetting Co., Fargo, N. Dak.	Lehigh	1929	Semicoke.[1]
Oklahoma	Lincoln Power Co., 1504 South Grand Avenue, St. Louis, Mo.	Howe	1929	Bituminous slack.
Wisconsin	Berwind Fuel Co., 122 South Michigan Avenue, Chicago, Ill.	Superior	1912	Semibituminous slack.
Do	Stott Briquet Co., Merchants National Bank Building, St. Paul, Minn.	do	1909	Anthracite fines and bituminous slack.
Do	United Coal & Dock Co., 8 Wells Street, Milwaukee, Wis.	Milwaukee	1928	Bituminous slack.
Pacific Coast States:				
California	San Diego Gas & Electric Corporation, Electric Building, San Diego, Calif.	San Diego	1925	Carbon (petroleum residue).
Oregon	Portland Gas & Coke Co., 206 Sixth Street, Portland, Oreg.	Portland	1913	Do.
Washington	Pacific Coast Coal Co., 612 L. C. Smith Building, Seattle, Wash.	Renton	1914	Coking bituminous slack and free-burning slack.
Do	Paramount Briquet Co., 1721 Northlake Place, Seattle, Wash.	Seattle	[2] 1929	Bituminous slack.
Do	Wilkeson Coal & Coke Co., Wilkeson, Wash.	Fairfax	1926	Do.

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[1] The residue of low-temperature carbonization of bituminous coal or lignite.

[2] The Paramount Briquet Co., whose newly erected plant at Seattle, Wash., went into operation in 1929, is successor to the Northwestern Briquetting Co., whose plant at Ravensdale, Wash., was destroyed by fire in 1928.

CAPACITY OF PLANTS

As more than half of the plants worked from 14 to 24 hours during the busy season, the measurement of capacity on an hourly basis affords a good indication of potential output. In 1929 two plants had a capacity of less than 5 tons per hour, and the three largest had a capacity exceeding 75 tons. Five plants in 1929 had an hourly capacity of more than 50 tons, as compared with only two plants in 1928.

Classification of briquet plants, by hourly capacity in 1929

Capacity per hour	Number of plants
Less than 5 net tons	2
5 and less than 10	6
10 and less than 25	8
25 and less than 50	4
50 and less than 75	2
75 net tons and over	3
	25

A further conception of the prevailing size of the briquetting operations may be obtained by grouping them according to their total production in 1929. As shown in the following table, 7 plants produced less than 2,000 tons during the year, 5 produced between 10,000 and 25,000 tons, and 4 produced between 25,000 and 100,000 tons. In 1929, as in immediately preceding years, the output of 2 plants exceeded 200,000 tons. In view of the fact that the Bureau of Mines classifies a coal mine producing 200,000 tons as a "large" mine and groups all mines above that limit in "Class I," it is evident that some of the briquetting plants are of considerable size.

Classification of briquet plants, by size of output in 1929

Output	Number of plants
Less than 2,000 net tons	7
2,000 and less than 5,000	3
5,000 and less than 10,000	2
10,000 and less than 25,000	5
25,000 and less than 100,000	4
100,000 and less than 200,000	2
200,000 net tons and over	2
	25

HOURS OPERATED PER DAY

As already noted, the sharp seasonal demand for briquets is met by rapidly expanded production rather than from accumulations of producers' stocks. Hence, during the busy season many plants work two or even three shifts a day. Thirteen plants, producing 92 per cent of the total output in 1929, reported that they operated 14 hours or more a day. The twelve plants working from 8 to 12 hours a day contributed only 8 per cent of the total production.

Classification of briquet plants, by number of hours operated per day during busy season in 1929

Hours per day	Number of plants	Production (net tons)
14 to 24 hours	13	1,113,690
8 to 12 hours	12	98,725
	25	1,212,415

RAW FUELS

A total of 1,187,939 net tons of raw fuel of all kinds was briquetted in 1929; 34 per cent of this amount was anthracite and semianthracite, 60 per cent semibituminous and bituminous coal, and 6 per cent semicoke and carbon residue from the manufacture of oil gas.

Ten plants reported that from a small portion to all of the raw coal used was washed either by the colliery operator or the briquet manufacturer.

Raw fuels used in making briquets in the United States, 1925–1929, in net tons

Fuel	1925	1926	1927	1928	1929
Anthracite culm and fine sizes and semianthracite	[1] 383,189	426,064	359,438	376,257	408,967
Semibituminous, bituminous, and subbituminous slack	394,486	480,684	521,318	512,806	[2] 711,459
Semicoke and oil-gas residue	66,915	64,387	70,052	51,743	67,513
	844,590	971,135	950,808	940,806	1,187,939

[1] Revised figures. [2] Includes no subbituminous coal.

In 1929 anthracite and semianthracite fines were used either alone or in combination with other coal as a raw material at 13 operations. Bituminous coal alone was used at 7 plants. The character of the raw fuel used by the 25 active plants was as follows:

Classification of briquet plants, by kinds of raw fuel used in 1929

Kind of raw fuel used	Number of plants
Anthracite fines	6
Semianthracite fines	2
Mixture of anthracite or semianthracite fines and bituminous or semibituminous slack	5
Bituminous slack	7
Semibituminous fines	1
Semicoke (low-temperature coke or char)	2
Carbon residue from the manufacture of oil gas	2
	25

BINDERS AND RECARBONIZATION

Asphaltic pitch is the binder most often used in the manufacture of briquets and was employed either alone or in combination by 16 out of the 25 plants active in 1929. Fifteen producers used asphaltic pitch exclusively; 1, asphaltic pitch and coal-tar pitch; 2, a mixture of starch, asphalt, and water; 2, sulphite liquor; 1, coal-tar pitch; 1, oil-tar pitch; and 2, patent binders. One plant, briquetting the carbon residue from oil gas, required no binder.

The percentage of binder to raw fuel, by weight, ranged from less than 5 to 9 per cent or more. The proportion most commonly used was 5 or 6 per cent.

Classification of briquet plants, by percentage of binder used in 1929

Binder used	Number of plants
Using no binder (carbon residue)	1
Using—	
Less than 5 per cent binder	4
5 and less than 7 per cent	12
7 and less than 9 per cent	5
9 per cent and over	3
	25

Four of the producers using a binder, whose total output was 17,638 tons, reported that they recarbonized the briquets coming from the presses to drive off smoke from the binder.

FOREIGN TRADE IN BRIQUETS

Imports of fuel briquets in 1929 were 89,458 net tons, an increase of 17,973 tons, or 25 per cent, over 1928. Before 1922 the quantity of briquets imported was negligible. The anthracite shortages of 1922–23 and 1925–26, however, accelerated the introduction of the European product into the New England market. Although supplies of anthracite have been abundant from 1927 to 1929, the volume of briquet imports has persisted at a high level when compared with the period prior to 1926. In 1929 the imports were equivalent to 7.4 per cent of the domestic production.

According to the customs records, 78,296 tons, or about 88 per cent of the total imported in 1929, was discharged at or in the vicinity of Boston; Maine and New Hampshire received 6,578 tons and Rhode Island 4,424 tons. Very small tonnages were also imported into Vermont, New York, North Dakota, and Michigan.

Of the total imports 84,492 tons, or 94.4 per cent, came from Germany, 4,368 tons from Netherlands, 550 tons from Canada, and 48 tons from France.

Briquets and other composition coals for fuels imported for consumption in the United States, 1919–1929 [1]

Year	Net tons	Value	Year	Net tons	Value
1919	136	$1,050	1925	6,758	$43,931
1920	(2)	9	1926	123,593	736,804
1921	66	251	1927	60,601	314,435
1922	34,862	139,382	1928	71,485	353,168
1923	19,559	103,201	1929	89,458	458,517
1924	38	443			

[1] Compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

[2] 112 pounds.

The following table shows that the volume of imports from month to month during the year follows much the same seasonal trend that production normally follows.

Fuel briquets imported into the United States in 1929, by months, in net tons

[General imports]

Month	Net tons	Month	Net tons	Month	Net tons
January	12, 902	May	8, 731	September	6, 720
February	14, 123	June	10	October	45
March	8, 415	July	4	November	8, 099
April	13, 071	August	3	December	17, 335

WORLD PRODUCTION

The world production of briquetted fuel is now about 56,000,000 metric tons a year. Germany is by far the greatest producer and accounts for more than four-fifths of the world total. France and Belgium are the second and third largest producers. At present the United States contributes approximately 2 per cent of the world production. The briquetting industry has attained its greatest development in countries where a large part of the available fuel is of low grade and where market conditions warrant its conversion from the raw state to briquets.

World production of fuel briquets, 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
Algeria	74, 495	57, 442	83, 338	86, 079	(2)
Belgium	2, 237, 171	2, 142, 660	1, 688, 970	1, 959, 130	1, 999, 280
Czechoslovakia:					
Coal	156, 477	181, 797	160, 254	214, 613	270, 294
Lignite	211, 884	197, 211	211, 770	241, 174	256, 109
France	5, 781, 037	6, 142, 355	3, 904, 160	4, 061, 838	4, 634, 866
Germany: [3]					
Coal	5, 590, 613	5, 901, 593	5, 554, 980	5, 375, 842	5, 554, 480
Lignite	33, 663, 447	34, 358, 043	36, 489, 901	40, 157, 264	42, 268, 752
Saar		746	285		(2)
Great Britain	1, 243, 090	850, 774	1, 502, 053	1, 151, 270	(2)
Hungary:					
Coal	32, 826	58, 851	42, 553	56, 165	(2)
Lignite					
Indo-China	89, 820	97, 456	119, 700	103, 518	(2)
Netherlands:					
Coal	570, 717	714, 884	662, 210	785, 829	(2)
Lignite	68, 463	70, 256	69, 111	69, 091	(2)
Netherland East Indies	22, 644	96, 159	112, 543	82, 629	(2)
Poland	375, 100	239, 160	252, 779	264, 362	354, 783
Spain	670, 974	686, 707	803, 127	846, 645	921, 906
United States	761, 460	902, 945	880, 389	859, 483	1, 099, 879
Venezuela	2, 043	2, 399	2, 297	1, 232	1, 691
Yugoslavia	31, 255	(4)	(4)	27, 582	51, 477
	51, 583, 516	52, 731, 438	52, 570, 420	56, 343, 746	(2)

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[1] In addition to the countries listed, briquets are produced in Australia, Canada, and New Caledonia, but data of output are not available.

[2] Data not available.

[3] Exclusive of the Saar.

[4] Estimate included in total.

SILICA[1][2]

INTRODUCTION

Silica (SiO_2) occurs in deposits of commercial importance in many different forms, such as vein quartz, as a constituent of pegmatites, as sand, sandstone, quartzite, or flint, as tripoli, and as diatomite or diatomaceous earth. In some forms, such as rose, smoky, and amethystine quartz, it has value as gems. This chapter deals with silica of all kinds except gem quartz, silica sand or sandstone used for making glass, and silica used in the form of sand, gravel, and crushed material for building, for concrete and mortar, for foundry and furnace work, and for cutting and grinding stone. Such material as is not included here is either gem material or sand, is commercially so designated, and is therefore considered in other chapters of Mineral Resources. Tripoli and diatomite were, in the past, largely consumed as abrasives and are considered in the chapter on abrasive materials; however, both are finding increasing markets for other than abrasive purposes. As it is impossible to separate the figures in order to show the quantities used for other purposes, the figures given here for diatomite and tripoli are duplicated in the abrasive chapter.

For a comprehensive discussion of the occurrence, mining or quarrying, methods of preparation, and uses of the various forms of silica the reader is referred to a report by W. M. Weigel, Technology and Uses of Silica and Sand, Bulletin 266, Bureau of Mines, 1927, which may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 40 cents a copy.

PRODUCTION

The production of quartz (crude, crushed, and ground) from pegmatite dikes, from veins, and from quartzite decreased 5 per cent in quantity and 2 per cent in value in 1929, as compared with 1928. Ground sand and sandstone increased 8 per cent in quantity and 4 per cent in value.

Silica sold or used by producers in the United States for pottery, paints, fillers, polishers, abrasives, and other uses, 1927–1929

Material	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Quartz (vein quartz, pegmatite, and quartzite)	22,144	$194,040	22,198	$209,333	20,981	$205,759
Sand and sandstone [a]	275,737	1,897,303	280,402	1,966,296	302,139	2,039,144
Tripoli (including rottenstone) (ground and otherwise prepared)	26,099	447,068	34,043	555,576	38,011	545,658
Diatomite	(b)	(b)	(b)	(b)	(b)	(b)
	(b)	(b)	(b)	(b)	(b)	(b)

[a] Includes only finely ground material. Figures probably incomplete.
[b] Bureau of Mines not at liberty to publish figures for diatomite.

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[1] Work on manuscript completed August, 1930.

[2] Statistics on production were prepared by Estelle R. Phillips, of the Bureau of Mines. Figures on imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

QUARTZ

The States from which production of quartz (from pegmatite dikes, from veins, and from quartzite) was reported in 1929 were California, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New York, North Carolina, Virginia, Washington, and Wisconsin. California reported the largest production. The mining of some crystal quartz was reported from California.

The total quantity of crude, crushed, and ground quartz sold or used by producers in 1929 amounted to 20,981 short tons, valued at $205,759. This output consisted of 10,224 tons of crude quartz, valued at $36,078; 2,880 tons of crushed quartz, valued at $23,179; and 7,877 tons of ground quartz, valued at $146,502.

Some of the crude quartz included in the foregoing figures was purchased by grinders who reported an additional production of 8,592 tons of ground quartz, valued at $178,813. This output of ground quartz, with the 7,877 tons reported by the original producers of the crude material, made a total of 16,469 tons of ground quartz, valued at $325,315.

Average values f. o. b. mines for the crude quartz reported by individual producers ranged from $2 to $5.80 a short ton, with an average sales value of $3.53 for the total quantity reported for the country. Corresponding values for crushed quartz ranged from $6.35 to $20.02 and averaged $8.05 a ton for the total output.

Average values of the ground quartz reported by individual producers ranged from $8.60 to $33.41 a ton. The average sales value of all ground quartz considered here was $19.75 a ton.

In 1929 production was reported by the following manufacturers of ground quartz, some using it in the manufacture of other products:

American Encaustic Tiling Co. (Ltd.), 2030 East Fifty-second Street, Los Angeles, Calif.
Baeder-Adamson Co., Philadelphia, Pa.
Behr-Manning Corporation, Troy, N. Y.
Charlotte Chemical Laboratories (Inc.), Charlotte, N. C.
Erwin Feldspar Co. (Inc.), Erwin, Tenn.
Eureka Flint & Spar Co., Trenton, N. J.
Flynt Silica & Spar Co., 1047 Richmond Street, Los Angeles, Calif.
Maryland Quartz Co., 73 Munsey Building, Baltimore, Md.
Minnesota Mining & Manufacturing Co., St. Paul, Minn. (successor] to Wausau Abrasives Co., in November, 1929).
Poxon China Co., Huntington Park, Calif.
H. P. Scheel Eversharp Pulp-Burr Co., 520 North G Street, Tacoma, Wash.
Spicky Polish Corporation, 1401 Third Street, San Francisco, Calif.
Standard Flint & Spar Corporation, Trenton, N. J.
Standard Sanitary Manufacturing Co., Box W, Richmond, Calif.
Trenton Flint & Spar Co., Trenton, N. J.
United States Sandpaper Co., Williamsport, Pa.
Wausau Abrasives Co., Box 436, Wausau, Wis. (succeeded by Minnesota Mining & Manufacturing Co., in November, 1929).

Companies that reported "crushed" (not "ground") material in 1929 were as follows:

The Enos Adams Co., Bennington, Vt. (mill at Adams, Mass.).
Cheshire White Quartz Sand Co., Cheshire, Mass.
San Jacinto Rock Products Co., San Jacinto, Calif.

Quartz sold or used by producers in the United States, 1920–1929

Year	Crude[1]		Ground[2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	59, 423	$142, 397	8, 767	$177, 953	68, 190	$320, 350
1921	8, 570	39, 660	2, 682	45, 297	11, 252	84, 957
1922	5, 085	23, 093	5, 568	78, 254	10, 653	101, 347
1923	14, 159	66, 723	6, 442	126, 907	20, 601	193, 630
1924	20, 570	123, 099	3, 191	80, 078	23, 761	203, 177
1925	22, 312	143, 861	3, 132	61, 515	25, 444	205, 376
1926	22, 230	159, 052	5, 513	115, 281	27, 743	274, 333
1927	18, 504	124, 021	3, 640	70, 019	22, 144	194, 040
1928	15, 363	79, 229	6, 835	130, 104	22, 198	209, 333
1929	13, 104	59, 257	7, 877	146, 502	20, 981	205, 759

[1] Includes some crushed quartz.

[2] In order to avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

Quartz (crude, crushed, and ground[1]) sold or used by producers in the United States, 1927–1929, by States

State	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
California	6, 755	$61, 802	5, 719	$47, 789	5, 573	$58, 807
Maryland	4, 409	37, 717	3, 515	10, 466	3, 670	8, 875
Nevada	1, 030	6, 180	(2)	(2)	346	2, 358
New Hampshire	(2)	(2)	376	2, 593	(2)	(2)
New York	520	2, 597	(2)	(2)	(2)	(2)
North Carolina	3, 396	19, 853	4, 113	40, 128	2, 493	28, 709
Washington	273	2, 070	(2)	(2)	(2)	(2)
Undistributed[3]	5, 761	63, 821	8, 475	108, 357	8, 899	107, 010
	22, 144	194, 040	22, 198	209, 333	20, 981	205, 759

[1] In order to avoid duplication, the ground material included is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

[2] Included under "Undistributed."

[3] 1927: Maine, Massachusetts, New Hampshire, Pennsylvania, Virginia, and Wisconsin; 1928: Massachusetts, Nevada, New York, Pennsylvania, Washington, and Wisconsin; 1929: Maine, Massachusetts, New Hampshire, New York, Virginia, Washington, and Wisconsin.

Following is a list of some producers and sellers of crude quartz who have produced in recent years or who will produce when market offers:

Apex Engineering Co., 609 Rookery Building, Spokane, Wash.
Apex Quartz Co., St. Clair, Mo.
Gottlieb Baer, Marriottsville, Md.
P. Carmean, Le Grand, Calif.
Carolina Minerals Co., Spruce Pine, N. C.
Charlotte Chemical Laboratories (Inc.), Charlotte, N. C.
Consolidated Feldspar Corporation, Trenton, N. J.
Crystal Quartz Co., 1289 Sunset Boulevard, Los Angeles, Calif.
J. W. Cummings Feldspar Co., Bath, Me.
Day Quartz Co., Sykesville, Md.
Eastern Mining Co., Province Lake, N. H.
Eureka Flint & Spar Co., Trenton, N. J.
F. B. Fortner, Spruce Pine, N. C.
Gold Cliff Central Mining Co., Kingman, Ariz.
Golding-Keene Co., Keene, N. H.
C. L. Graber, Cleveland, Ohio.
L. I. Green, Owings Mills, Md.
John T. Hanley, R. F. D., West Rumney, N. H.

Maine Feldspar Co., Brunswick, Me.
Minnesota Mining & Manufacturing Co., St. Paul, Minn.
Northwest Mineral Products Co., Tacoma, Wash.
W. H. O'Dell, Randallstown, Md.
J. R. Oursler, Marriottsville, Md.
Perris Mining Co., Perris, Calif.
Anthony Pesente, Woodbury, Conn.
J. C. Pitman, Penland, N. C.
Wm. Retallick, Roxbury Station, Conn.
H. T. A. Rhodewalt, Nottingham, Pa.
C. L. Roesbery, Yermo, Calif.
H. P. Scheel Eversharp Pulp-Burr Co., 520 North G Street, Tacoma, Wash.
Galen Sparks, Spruce Pine, N. C.
Spicky Polish Corporation, 1401 Third Street, San Francisco, Calif.
Stockton Mineral Products Co., Stockton, Calif.
N. M. Sweetser, Rosamond, Calif.
John Wallen, Marriottsville, Md.
Geo. W. Wheatley, Moneta, Va.
Whitehall Co. (Inc.), 17 Battery Place, New York, N. Y.
W. M. Yox, Reisterstown, Md.

GROUND SAND AND SANDSTONE

Ground sand and sandstone amounting to 302,139 short tons, valued at $2,039,144, were sold or used in 1929 by producers in California, Illinois, Missouri, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.

There is a great variation in the purity, fineness, and perfection of sizing of the ground sand and sandstone produced, which results in a wide range of average values for the output of the individual operators. This average ranged from $3.27 to $20.61 a ton in 1929. The average value for the total output of ground sand and sandstone was $6.75 a ton.

The following producers reported ground sand or sandstone in 1929:

Central Silica Co., Glass Rock, Ohio.
Clinch Mountain Silica Sand Corporation, Box 476, Richmond, Va.
Crystal Silica Sand Co., 716 East Sixtieth Street, Los Angeles, Calif.
Del Monte Properties Co., 401 Crocker Building, San Francisco, Calif.
Eureka Flint & Spar Co., Trenton, N. J.
Michigan Quartz Silica Co., Milwaukee, Wis.
National Pulverizing Co., Millville, N. J.
National Silica Co., Oregon, Ill.
National Silica Works, Berkeley Springs, W. Va.
New Jersey Pulverizing Co., 15 Park Row, New York, N. Y.
Ottawa Silica Co., Ottawa, Ill.
Pennsylvania Glass Sand Co. (grinds in New Jersey, Pennsylvania, and West Virginia), Lewistown, Pa.
Pioneer Silica Products Co., Pacific, Mo.
Potters Mining & Milling Co., East Liverpool, Ohio.
Standard Flint & Spar Corporation, Trenton, N. J.
Standard Silica Co., 120 South La Salle Street, Chicago, Ill.
Wedron Silica Co., First National Bank Building, Chicago, Ill.

Ground sand and sandstone sold or used by producers in the United States, 1920–1929 [1]

Year	Short tons	Value	Year	Short tons	Value
1920	158,395	$1,183,014	1925	263,981	$1,857,263
1921	105,887	802,450	1926	270,468	1,928,793
1922	163,295	1,061,057	1927	275,737	1,897,303
1923	249,467	1,672,961	1928	280,402	1,966,296
1924	230,432	1,655,056	1929	302,139	2,039,144

[1] Includes only finely ground material. Figures probably incomplete.

Ground sand and sandstone sold or used by producers in the United States, 1928 and 1929, by States [1]

	1928		1929	
	Short tons	Value	Short tons	Value
Illinois and Missouri	81, 883	$523, 373	94, 920	$580, 649
New Jersey	84, 786	403, 813	83, 304	350, 480
Virginia and West Virginia	56, 603	504, 383	56, 601	496, 626
California, Ohio, Pennsylvania, and Wisconsin	57, 130	534, 727	67, 314	611, 389
	280, 402	1, 966, 296	302, 139	2, 039, 144

[1] Includes only finely ground material. Figures probably incomplete.

IMPORTS

Data on imports of silica materials are found in the records of the Bureau of Foreign and Domestic Commerce under the classifications "silica, crude," "silica, for use as pigment," and "flint, flints, and flint stones, unground." There were no imports of crude silica recorded for 1929 or 1928. Imports of crude silica were reported for 1927 from the Philippine Islands and amounted to 12 short tons, valued at $175. Imports of crude silica reported for 1926 were 27 tons, valued at $149; for 1925, 22 tons, valued at $486. Imports of silica for use as pigment amounted to 22 short tons, valued at $535, in 1927; none were separately recorded for 1929, 1928, 1926, or 1925. The imports of "flint, flints, and flint stones, unground," are flint pebbles for grinding mills and for other uses such as are listed in this report; the "general" imports amounted to 14,047 short tons, valued at $127,186, in 1929, 15,719 tons, valued at $144,313, in 1928, 15,191 tons, valued at $93,658, in 1927, 15,091 tons, valued at $120,078, in 1926, and 16,240 tons, valued at $105,041, in 1925.

The imports of "flint, flints, and flint stones, unground," from France in 1929 amounted to 65 per cent of the total quantity imported; from Denmark, 24 per cent; and from Belgium, 10 per cent. The balance came from Germany and Argentina.

The values assigned to the imports considered in the following tables are those upon which the import duties in the United States are levied and represent the foreign market value (or the export value, if higher) plus cost of containers and all expenses incident to placing merchandise ready for shipment to the United States, including export tax, if any.

"Flint, flints, and flint stones, unground," imported for consumption in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	26, 636	$338, 630	1925	16, 240	$105, 041
1921	10, 084	116, 157	1926	15, 091	120, 078
1922	16, 040	145, 805	1927	15, 191	93, 658
1923	15, 952	130, 974	1928	15, 719	144, 313
1924	17, 473	114, 958	1929	14, 097	127, 457

"Flint, flints, and flint stones, unground," imported into the United States, 1927–1929, by countries

[General imports]

Country	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Argentina					11	$129
Belgium	1,089	$14,513	969	$18,379	1,436	25,378
Canada			44	384		
Denmark	3,148	24,812	6,716	74,595	3,365	34,160
France	10,953	54,307	7,816	49,190	9,157	66,327
Germany			20	447	78	1,192
Netherland East Indies ("Other")			61	470		
Sweden	1	26	59	675		
United Kingdom			34	173		
	15,191	93,658	15,719	144,313	14,047	127,186

GRAPHITE [1]

By JEFFERSON MIDDLETON

INTRODUCTION

This chapter presents statistics relating to graphite in 1929 and recent preceding years, together with brief textual matter on the subject.

The outstanding feature of 1929 in the graphite industry was the increasing use of amorphous graphite, not only in the United States, as shown by increasing sales and imports, but throughout the world. This condition possibly is caused by new uses for amorphous graphite and by the expansion of industries using this kind of graphite.

The values given for domestic graphite are f. o. b. plants; those for imports, at the principal markets of the countries from which the graphite was exported; and those for exports, at the port of shipment.

PRODUCTION

In the following discussion the quantity and value of graphite sold or used by producers in the United States are presented as the best available measure of output.

During 1929 the graphite industry progressed. The quantity of natural graphite sold or used by producers in 1929 amounted to 6,458 short tons and was valued at $310,891, an increase of 15 per cent in quantity and 5 per cent in value compared with 1928. The increase in quantity was chiefly in amorphous graphite, that variety accounting for two-thirds of the total increase. The total quantity includes 3,555 tons of amorphous and 2,903 tons (5,806,410 pounds) of crystalline, an increase of 19 per cent in amorphous and 11 per cent in crystalline. The value of the amorphous variety was $46,650 in 1929, an increase of 8 per cent over its value in 1928, and that of the crystalline was $264,241, an increase of 4 per cent. The quantity and value of the crystalline graphite in 1929 were the largest since 1920.

The States contributing to the total in 1929 were Alabama, Michigan, Nevada, Rhode Island, and Texas. Two States reported crystalline graphite in 1929—Alabama and Texas; Georgia and New Jersey, which reported sales of this variety in 1928, reported none for 1929. In Alabama there were four producers: The Bama Graphite Co., Mountain Creek; the Superior Flake Graphite Co., Chicago, Ill., with mine at Ashland; the Alabama-Quenelda Graphite Co., Birmingham, with mine near Lineville; and the Southwestern Consolidated Graphite Co., Boston, Mass., with mine at Hollins. In Texas the only producer was the Southwestern Consolidated Graphite Co., with mine at Burnet and plants at Burnet and Houston.

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[1] Work on manuscript completed July, 1930.

Three States reported amorphous graphite sold or used by the producer in 1929: Rhode Island, Michigan, and Nevada, named in the order of their importance. The only operators reporting were the Detroit Graphite Co., Detroit, Mich., with mine at L'Anse; the Carson Black Lead Co., Oakland, Calif., with mine at Carson, Nev.; and the Graphite Mines Co., Providence, R. I., with mine at Cranston.

Natural graphite sold or used by producers in the United States, 1920–1929

Year	Number of operators reporting sales	Amorphous		Crystalline		Total value
		Short tons	Value	Pounds	Value	
1920	17	4,694	$49,758	9,632,360	$576,444	$626,202
1921	8	1,842	20,860	1,189,523	75,664	96,524
1922	7	2,200	(1)	1,849,766	85,242	(1)
1923	7	4,056	39,560	3,964,900	151,434	190,994
1924	5	4,071	38,533	1,800,325	48,977	87,510
1925	6	3,536	39,640	2,257,250	56,721	96,361
1926	6	2,975	40,500	4,989,200	178,842	219,342
1927	9	2,595	35,850	5,224,400	197,121	232,971
1928	9	2,994	43,320	5,233,300	253,773	297,093
1929	8	3,555	46,650	5,806,410	264,241	310,891

[1] Bureau of Mines not at liberty to publish value.

USES

Natural graphite is used chiefly in the manufacture of foundry facings, pigments and paints, crucibles, pencils and crayons, commutator brushes, stove polish, lubricants, retorts, and batteries. During the last few years the uses of graphite in the United States have changed radically. Uses that a few years ago consumed a large proportion of the supply are now of relatively minor importance, and uses that were unimportant have become important. Before the World War the manufacture of graphite crucibles consumed more than one-half of the supply; in 1923 only 15 per cent of the graphite used in the manufacture of finished products was used in the manufacture of crucibles and in 1924 only 13 per cent. Foundry facings used only 10 per cent of the graphite in 1913; the quantity so used in 1923 was 44 per cent and in 1924, 52 per cent.

Crystalline graphite was reported as having been sold in 1929 for use in batteries, carbons (electrodes), crucibles, lubricants, paints, and stove polish. Amorphous graphite was reported as having been sold or used for paint manufacture.

MANUFACTURED GRAPHITE

In 1929 graphite was manufactured by the Acheson Graphite Co., Niagara Falls, N. Y., and by the American Cyanamid Co., at Linden, N. J. This branch of the industry was started in 1897 under patents obtained by Dr. E. G. Acheson and was developed so rapidly that after 10 years the production of artificial graphite exceeded that of natural crystalline graphite. Since 1910, except in 1915 to 1920 and in 1929, the annual output of manufactured graphite has exceeded the combined output of domestic amorphous and crystalline graphite. The Bureau of Mines is not at liberty to publish figures of production for 1928 and 1929, as doing so would disclose confidential information.

PRICES

In 1929 the average value of domestic crystalline graphite at the mine ranged from 4 to 6.9 cents per pound, and compared with 1½ to 5.8 cents per pound in 1928. The general average value of domestic crystalline graphite in 1929 was 4.6 cents per pound as compared with 4.8 cents in 1928.

The figures in the following table have been furnished by Charles Pettinos, of New York.

Average prices of Ceylon graphite, c. i. f. New York, 1920–1929, in cents per pound

Year	Lump		Chip		Dust		Remarks
	First grade	Second grade	First grade	Second grade	First grade	Second grade	
1920	9 -14	7 -11	7 -10	5½-7½	5 -7	3½-5	High first half; low second half.
1921	5½- 6	4½- 5	4½- 5	3½-4	3¼-3¾	2 -2½	Low throughout the year.
1922	5 - 6	4 - 4½	3¾- 4¼	3¼-3¾	3 -3½	2 -2½	Do.
1923	5 - 6	4 - 4½	3¾- 4¼	3¼-3¾	3 -3½	2 -2½	Do.
1924	5½- 7	4½- 6	4 - 6	3½-5	3¼-4½	2 -3	Low first three-quarters; high last quarter.
1925	7½- 9½	6½- 8½	6½- 7½	5½-6½	3½-5½	3 -4½	High throughout the year.
1926	7½- 9½	6½- 8½	6½- 7½	5½-6½	3½-5½	3 -4½	Do.
1927	7½- 9½	6½- 8½	6½- 7½	5½-6½	3½-5½	3 -4½	Do.
1928	7½- 9½	6½- 8½	6½- 7½	5½-6½	3½-5½	3 -4½	Do.
1929	7½- 9½	6½- 8½	6½- 7½	5½-6½	3½-5½	3 -4½	Do.

The following information has also been furnished by Mr. Pettinos: The price range for 1929 for Madagascar graphite was 6½ to 7 cents per pound, ex dock at New York, including duty and other charges.

The exports from Madagascar are virtually all of one quality, called "Standard No. 1 Flake," the grade that the French Government is attempting to have the producers maintain and which has a graphitic carbon content of approximately 85 per cent. The size of grain runs from 20 to 60 mesh, practically all passing 20 mesh and all remaining on 60 mesh.

IMPORTS AND EXPORTS[2]

In 1929 both the quantity and the value of the graphite imported for consumption increased considerably as compared with 1928; the quantity increased 37 per cent and the value increased 33 per cent. The increase in the total quantity of graphite imported was due largely to the increase of 4,342 tons, or 56 per cent, in the quantity of amorphous graphite, and the increase in the total value of imports was due largely to the increase of $184,013, or 27 per cent, in the value of the crystalline graphite imported.

Amorphous graphite, which fell in 1928 for the first time in many years to less than one-half of the total quantity imported, again constituted 50 per cent of the total in 1929. The value of the crystalline graphite imported, however, was 82 per cent of the total in 1929, as compared with 87 per cent in 1928. The small proportion of the total value of imports represented by amorphous graphite is partly accounted for by the fact that the large imports from Mexico

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[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

(more than 70 per cent of the total amorphous graphite imported) are crude graphite of low unit value.

The reports of the Bureau of Foreign and Domestic Commerce on imports show only the country from which the graphite is shipped, which is not always the country of origin. For instance, the graphite shown as imported from France probably came principally from Madagascar, that from the United Kingdom should probably be credited to Ceylon and Madagascar, and that from Belgium to Italy. The shipments credited to Japan probably consisted wholly of graphite from Chosen.

Graphite imported for consumption in the United States, 1920–1929, by kinds

Year	Amorphous		Crystalline chip or dust		Crystalline flake		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	(1)	(1)	(1)	(1)	(1)	(1)	21,095	$1,711,312
1921							8,183	452,076
1922							12,488	473,046
1923	11,252	$149,831	7,243	$426,417	939	$37,871	19,434	614,119
1924	10,936	113,751	3,998	197,867	1,441	87,893	16,375	399,511
1925	9,210	143,750	5,904	389,242	2,654	293,418	17,768	826,410
1926	8,250	161,564	5,258	433,848	2,658	325,821	16,166	921,233
1927	9,559	146,881	6,116	390,822	1,777	186,220	17,452	723,923
1928	7,699	107,936	7,143	452,424	2,727	241,199	17,569	801,559
1929	12,041	189,198	8,304	546,668	3,727	330,968	24,072	1,066,834

[1] Not separately classified prior to 1923.

Graphite imported into the United States, 1924–1929

[General imports]

Country	1924		1925		1926	
	Short tons	Value	Short tons	Value	Short tons	Value
Austria	5	$180				
Canada	1,137	58,628	2,268	$123,823	2,633	$178,249
Ceylon	3,632	171,804	5,616	365,371	4,795	390,336
China	253	3,905	88	1,502		
Chosen	251	2,768	439	5,330	(1)	(1)
France	851	57,009	2,052	230,056	723	96,811
Germany	2	282	25	3,256	126	13,217
India (British)	171	8,450	5	150	122	8,170
Italy	155	3,204	575	16,688	105	2,291
Japan	479	8,362	191	9,983	[1] 880	[1] 21,794
Java and Madura					61	4,041
Madagascar	429	11,145	168	10,466	1,014	108,846
Mexico	8,984	70,380	6,159	39,119	5,238	45,968
Norway					14	2,078
Switzerland	17	1,944	13	1,600		
United Kingdom	9	1,450	180	20,738	483	51,712
	16,375	399,511	17,779	828,082	16,194	923,513

[1] Chosen included with Japan.

Graphite imported into the United States, 1924–1929—Continued

Country	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Australia	-----	-----	-----	-----	5	$396
Belgium	-----	-----	57	$4,451	34	4,665
Canada	1,676	$98,079	1,048	45,594	1,756	97,254
Ceylon	5,957	367,593	6,606	421,084	7,968	518,344
China	9	692	-----	-----	3	97
Chosen	(1)	(1)	(1)	(1)	(1)	(1)
Czechoslovakia	-----	-----	-----	-----	44	1,093
France	1,419	156,154	2,351	213,319	2,787	252,701
French Indo-China	2	173	-----	-----	-----	-----
Germany	7	1,089	63	5,986	11	2,650
India (British)	-----	-----	234	4,203	-----	-----
Italy	27	694	119	3,065	189	4,456
Japan	[1] 1,834	[1] 25,176	[1] 1,643	[1] 25,356	[1] 1,362	[1] 23,032
Madagascar	162	12,459	494	37,661	1,248	85,727
Mexico	6,283	53,837	5,225	46,988	8,547	72,556
Morocco	42	4,529	-----	-----	-----	-----
Norway	1	61	-----	-----	1	155
Soviet Russia	-----	-----	1	46	-----	-----
Switzerland	3	471	-----	-----	(2)	13
United Kingdom	7	997	2	804	6	2,047
	17,429	722,004	17,843	808,557	23,961	1,065,186

[1] Chosen included with Japan.
[2] Less than 1 ton.

Graphite exported from the United States, 1920–1929

Year	Unmanufactured graphite		Manufactures of graphite [1]	Year	Unmanufactured graphite		Manufactures of graphite [1]
	Short tons	Value			Short tons	Value	
1920	607	$112,771	$610,261	1925	945	$142,122	$337,481
1921	921	95,998	679,359	1926	405	49,235	463,084
1922	569	78,094	255,019	1927	[2] 1,819	[2] 435,997	(2)
1923	908	138,542	335,778	1928	[2] 2,203	[2] 454,770	(2)
1924	1,022	144,108	250,957	1929	[2] 1,613	[2] 370,013	(2)

[1] After 1921, exclusive of crucibles, figures for which are not available.
[2] Classification for 1927, 1928, and 1929 reads "Graphite and manufactures, except crucibles."

WORLD PRODUCTION

The following table shows, so far as figures are available, the production of natural graphite throughout the world from 1925 to 1929.

World production of natural graphite, 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
Australia: New South Wales	----------	----------	10	----------	51
Austria	13,079	14,756	18,058	24,226	25,296
Brazil [2]	----------	----------	----------	9	15
Canada	2,331	2,474	1,659	995	1,325
Ceylon [2]	15,674	11,810	13,091	14,576	12,942
Chosen [2]	15,040	18,692	20,331	23,095	24,645
Czechoslovakia	18,466	30,818	41,113	32,332	(3)
France	1,139	950	900	(3)	(3)
Germany	16,853	14,304	17,773	17,464	(3)
Greenland [4]	32	----------	----------	----------	----------
Indo-China	[4] 221	[4] 815	[4] 410	(3)	(3)
Italy	9,937	9,605	8,395	7,030	6,050
Japan	1,010	498	633	442	(3)
Madagascar [2]	14,980	11,454	14,329	13,897	16,049
Mexico (amorphous)	6,264	4,435	6,818	5,257	5,721
Russia [5]	2,485	6,425	6,857	(3)	(3)
Spain	1,945	603	352	----------	----------
Union of South Africa	47	46	58	51	53
United States:					
Amorphous	3,208	2,699	2,354	2,716	3,225
Crystalline	1,024	2,263	2,370	2,374	2,634

[1] In addition to the countries listed, Argentina reports shipments of 2 tons of graphite in 1927; Tanganyika Territory, a production of 5 tons in 1928; and French Morocco, exports of 104 tons in 1929.

[2] Exports.

[3] Data not available.

[4] Concentrates.

[5] Year ended Sept. 30.

UNITED STATES IMPORT TRADE IN GRAPHITE DURING 1929

The following paragraphs quoted from a paper on the United States import trade in graphite during 1929, by Joseph Ulmer, of the minerals division, Bureau of Foreign and Domestic Commerce, and published by the United States Department of Commerce in Commerce Reports No. 19, May 12, 1930, may be of interest. The imports given for 1929 in this paper are general imports.

The major portion of the world's production of natural graphite, produced largely in 10 countries, is made up of amorphous material, and the demand for this variety is becoming increasingly important. This trend may be attributed in part to new applications and to the expansion of consuming industries, as well as to the substitution for the other more expensive varieties—crystalline flake and crystalline lump. Consumption of all varieties within the United States is estimated at about 60,000,000 pounds annually, two-thirds of which is imported. Amorphous grades represent by far the greatest tonnage.

Imports into the United States of all graphite in 1929 amounted to 47,922,028 pounds, having a value of $1,065,186. These totals represent an increase over 1928 of 12,236,364 pounds and $256,629, or 34 and 32 per cent, respectively—the largest since 1920. The increase over 1927 receipts was 37.5 per cent in quantity and 47.5 per cent in value. Of this additional quantity of all grades received in 1929 as compared with 1928, 68 per cent was of the amorphous variety, of which Mexico was the source of 80 per cent. Examination of import schedules reveals that these changes are due to two main causes—an augmented demand for amorphous grades and an increase in unit value of the crystalline lump and flake varieties. For example, Mexico, which supplies about 71 per cent of the United States foreign requirements, in 1929 shipped to the United States 6,644,096 pounds more amorphous graphite than in 1928. Madagascar (part via France) supplied 89.98 per cent of the imported crystalline flake and netted an increase in total value of 23.9 per cent as against 27.56 per cent in tonnage. Ceylon supplied 93.4 per cent of the total crystalline lump and increased its shipments by 2,179,937 pounds, or 1,090 tons—about 16.5 per cent—with an added value of $82,671, or 19.6 per cent.

The following table details the imports, by varieties, from originating countries:

Imports of graphite into the United States in 1929 [1]

Country of origin	Amorphous	Crystalline	
		Lump	Flake
	Pounds	*Pounds*	*Pounds*
Belgium	68,969		
Canada	2,598,478	314,380	599,617
Ceylon	404,238	15,392,018	140,121
Czechoslovakia	87,834		
France	710,147	631,550	4,232,615
Germany	9,255	13,740	
Italy	265,184	112,000	
Japan	2,722,903		
Madagascar			2,495,565
Mexico	17,094,287		
United Kingdom	1,620	10,222	
Other countries	7,800	400	9,085
Total	23,970,715	16,474,310	7,477,003

[1] Preliminary; subject to revision.

The situation in the leading countries furnishing graphite to the United States is briefly noted in the following paragraphs:

Ceylon.—Following a year of depression, 1929 began with considerable activity in the Ceylon graphite market. Prices went up with increasing demand and hasty buying of Germany and the United States and the reentry of the United Kingdom into the market. In consequence, certain mines lying dormant following the war were reopened and manned with labor released by the inactive rubber and coconut trade. By the end of the second quarter, however, general market conditions had slumped by reason of the lowering of Madagascan prices, the southwest monsoon, and high production costs. Price depression continued throughout the year, with little indication of improvement. This factor, together with possible tariff advances in the United States, which normally receives 50 per cent of Ceylon shipments, has caused exporters to view the future of the industry with much misgiving. Despite the requirements of certain industries for the Ceylon products, it is felt that increasing mining costs, labor difficulties, tariffs, and competitive world conditions ultimately will force the complete cessation of mining operations unless an unforeseen price advance occurs shortly.

France.—For several years France has averaged a production of about 900 metric tons, all from the Department of the Hautes Alpes. Apparent consumption within the country is estimated at 5,757 metric tons annually.

Mexico.—Graphite shipments from Mexico are principally from one Province, Sonora, and correspond very largely to production. In turn, production depends almost entirely upon absorption by the United States, the most important purchaser. Despite political conditions that arose in the first quarter of 1929, the output for the year increased 50 per cent,[3] attributable probably to improved facilities at the mines to the north of Guaymas and to a favoring situation in the United States. In 1928 exports to the United States recorded a decline of 18.8 per cent over 1927 shipments.

Madagascar.—The United States imports of graphite from Madagascar in 1929 were larger than in any year except 1920 since the war. According to Vice Consul J. S. Richardson, production for the year, as a whole, while slightly below 1928, compared favorably with the preceding 5-year average of between 13,000 and 14,000 metric tons.

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[3] Later official figures of output indicate a much smaller rate of increase than is here stated.

The following table shows, for comparison, the total exports during the years 1927, 1928, and 1929—the last mentioned greater than in any year since the war:

Exports of graphite from Madagascar

Country of destination	1927	1928	1929
	Pounds	*Pounds*	*Pounds*
England	11,003,159	12,775,657	11,880,589
France	15,344,016	11,437,465	15,341,811
Germany	3,661,840	4,389,359	3,384,061
Italy	742,950	196,209	806,884
United States	753,973	1,545,424	3,902,142
Other	61,729	293,212	
Total	31,567,667	30,637,326	35,315,487

In the first quarter the increased American demand was met largely from accumulated stocks. At the end of March the English concern, Masker Co., the largest single exporter, which had withdrawn from the market late in 1928, was recorded as accepting orders at 1,600 francs per ton for a product of 85 per cent carbon content, screening 70 per cent on 40 mesh and 80 per cent on 50 mesh. This activity, together with continued demand from the United States and renewed interest by France, resulted in the reopening of dormant operations and culminated with a monthly production of 1,000 metric tons by the end of June. At the close of the year slackened demand lowered the price to 1,500 francs per metric ton delivered at Tamatave for first-choice, large-flake, clean graphite. Inferior grades ranged lower to 1,250 francs per metric ton.

France, broadly speaking, exchanges Madagascan grades for the amorphous varieties produced in other countries. For three years prior to 1929, however, prices of the Madagascan flake remained consistently high, and poorer grades from other sources were substituted. This disinterestedness forced certain concessions amounting to price reductions early in 1929, so that, on the whole, the year may be taken as an average.

Chosen.—The production of graphite in Chosen during 1929 is estimated at 66,138,500 pounds, a decrease of 13,951,876 from the 1928 output, according to a report from Vice Consul C. H. Stephens, Seoul. Total exports for the year amounted to 54,333,968 pounds, leaving approximately 11,804,532 for refining at Fusan and Aushu. Exports in 1929, however, were 3,419,096 pounds greater than in the previous year. This increase involved solely amorphous graphite; flake shipments actually decreased approximately 8,556,999 pounds.

The outstanding feature of the price situation in Chosen during 1929 was the steady upward tendency of Fusan amorphous graphite from $13.90 per short ton on January 1 to $18.52 at the end of the year. The chamber of commerce at Fusan reports that the increased use of amorphous graphite in Japan in the manufacture of nitrogenous fertilizers has necessitated heavier shipments.

The percentage participation of the major countries in the United States graphite import trade, with respect to each of the three commercial graphite varieties, was as follows:

Percentage participation of leading countries in United States import of graphite in 1929

Country of origin	Amorphous		Lump		Flake		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Canada	10.8	30.1			8.0	9.5	7.3	9.1
Mexico	71.3	38.0					35.7	6.9
Japan	11.4	12.0					5.7	2.7
Ceylon	1.7	4.5	93.4	92.8			33.2	48.7
Madagascar					33.4	25.9	5.2	8.1
France	3.0	9.4	3.8	4.9	56.6	62.8	11.6	23.7
Other	1.8	6.0	2.8	2.3	2.0	1.8	1.3	.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The apparent inconsistencies of the percentage weights with accompanying values indicate clearly the underlying grade variations into which the "amorphous," "lump," or "flake" headings are divided by the trade. For example, whereas Mexico, Canada, and Japan supply 93.5 per cent of the amorphous imports, having a value of approximately 80 per cent of that total, Canada furnished about 11 per cent of the weight, representing 30 per cent of the value; Mexico, 71 per cent by weight but 38 per cent of the value; while Japan's quota was about even. Again, it is noted that amorphous graphite represents 50 per cent of the total tonnage imported, while the value of the lump variety is approximately the same.

GRAPHITE MINING IN CEYLON

The following extract from the Mining Journal (London), April 26, 1930, page 330, in regard to graphite mining in Ceylon in 1929, may also be of interest.

The exports of graphite from Ceylon for 1929 showed a decrease over 1928, but the average value per ton realized was Rs.214.28, against Rs.188.51, an increase of Rs.25.77 per ton. The actual figures for 1929 exports were 12,739 tons, against 1928 exports of 14,347 tons, and the value was Rs.2,729,639 against 1928 Rs.2,704,359.

The difference in value of these figures of the Ceylon Plumbago Association at its annual meeting, is greatly accounted for by the better class of graphite shipped. In 1928 there was still a lot of dump heaps on mines throughout the island, which were exploited to get very low-grade F. D. During 1929 these dump heaps were finished and owing to so few mines now working and the improvement shown in the present treatment methods the tailings left would be of no use. The decrease in shipments was due to the falling off in exports to Germany of 669 tons, and Italy, 325 tons. America was still the biggest customer, taking 6,698 tons, Germany 1,778 tons, the United Kingdom 1,590 tons, and Japan 1,117 tons.

The total tonnage of graphite consumed in the United States was about the same as it was in the year preceding the outbreak of the Great War. The outstanding difference was that a large part of this consumption now consisted of artificial and amorphous graphite and a much smaller part consisted of Ceylon lump. On the one hand the decline in the manufacture of crucibles has reduced the demand for the more expensive kinds of graphite, while on the other hand the consumption of the cheaper kinds of graphite has increased.

During 1929 the demand still held for carbon graphite, but the highest grade of Ceylon graphite for crucible purposes found a diffident market. For 1930 a better market is anticipated for these grades, but the figures offered are decidedly low and sellers are holding off for better prices.

The number of mines working at the beginning of the year was given as 281, but at the end of December there were only 74 mines working. In reality the mines producing a regular output of any importance would not exceed ten. So far as the export was concerned it was in the hands of a few dealers, and the small mines were dependent on them both with regard to prices and delivery.

The decrease in Naval armaments had a direct effect on the demand of Ceylon graphite, especially crystalline grade, but manufacturers of crucibles are now finding that the present low prices for high-grade Ceylon graphite make it economical to use it. It was for that reason that an increased demand for 1930 of these grades is expected in spite of the naval disarmament. The real crux of the position is how long the main mines now working can continue at the present low level of prices. There is no prospect of any extension of mining activities with things as they are. Ceylon can always command a sale for certain grades of graphite and if the few mine owners and dealers now functioning were to come to an agreement there could not be a better time for doing so.

CARBON BLACK[1]

By G. R. Hopkins and H. Backus[2]

SUMMARY

The carbon-black industry experienced a record-breaking year in 1929, when production was 47 per cent above that in 1928. There were probably very few lines of business that showed a higher percentage gain in output in 1929. The quantity of carbon black produced in 1929 amounted to 366,442,000 pounds, an increase over 1928 of 117,652,000 pounds. (See fig. 2.)

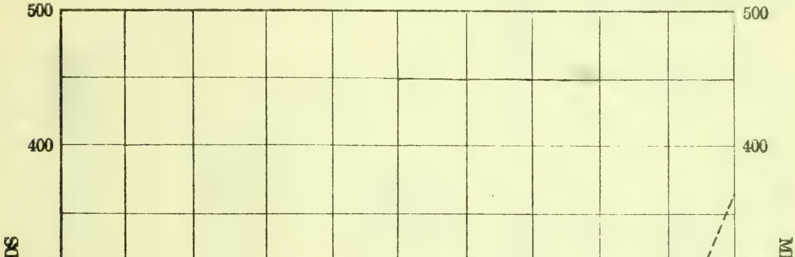

FIGURE 2.—Carbon-black production, stocks, and deliveries, 1919–1929

Carbon black is a jet-black, fluffy, extremely finely divided material made by burning natural gas in a deficiency of oxygen. It has been made from oil, but the results so far obtained have not justified the commercial use of this method. It can also be made from manufactured gas and from acetylene. The black obtained by burning manufactured gas is of high quality, but the high price of the gas prohibits the use of this method. Carbon black from acetylene is of inferior quality and owes its sale solely to certain special coloring properties.

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[1] Work on manuscript completed April, 1930.
[2] Figures on exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

There are two common methods of producing carbon black from natural gas—the "contact" method, in which the black is deposited when the flame impinges on a relatively cold surface, and the "furnace" method, in which natural gas is preheated, then burned with insufficient air under pressure in a tower containing refractory material. Of these the contact method is the more important; it accounted for at least 90 per cent of the total production in 1929. The contact method may be further divided, on the basis of the character of the contact surface, into the channel, disk, and roller processes. Of these the channel process is by far the most important; the other two are used principally to make black with special properties. During 1929 the production of carbon black by the channel process amounted to 327,552,000 pounds, or 89.4 per cent of the total output, while the production by the thermatomic, Lewis, roller, disk, and special processes amounted to 38,890,000 pounds, or 10.6 per cent.

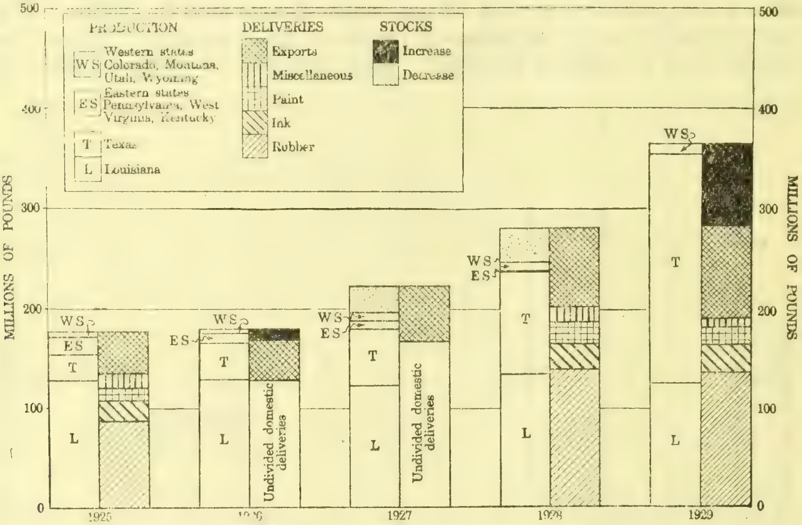

Figure 3.—Production and consumption of carbon black, 1925–1929

Deliveries to domestic companies for use in the manufacture of rubber, inks, and paints and for miscellaneous purposes totaled 191,977,000 pounds in 1929 and exports amounted to 91,829,000 pounds. (See fig. 3.)

Before the first use of carbon black soon after 1860, lampblack was the common coloring material, but because of the more intense color and greater tinting strength of carbon black its use in inks and paints gained rapidly in importance. Carbon black has practically supplanted lampblack in inks but probably will never completely replace it in paints or in specialized uses which require certain peculiar properties inherent in lampblack. Although the consumption of carbon black in printer's ink is not relatively large, it is perhaps the most important because no other product will replace carbon black in this particular use. One pound of carbon black mixed with 8 pounds of oil gives enough ink to cover nearly an acre of surface. No other coloring material can approach this "covering power."

Deliveries of carbon black to ink producers in 1929 amounted to 27,350,000 pounds, or 14 per cent of the total domestic deliveries, as compared with 27,223,000 pounds in 1928. The value of the carbon black used for this purpose in 1929 approximated $1,400,000, the equivalent of only an infinitesimal part of the value of the printed material that it helped to make.

The most important use of carbon black, as measured by volume, is as an ingredient in the manufacture of rubber. Carbon black was first used as a coloring agent in the manufacture of rubber about 1915, and in the comparatively short time since that year consumption for this purpose has grown to about 140,000,000 pounds annually. The actual amount of carbon black delivered to rubber companies in this country in 1929 was 138,474,000 pounds, or 72 per cent of the total domestic deliveries. As recently as 10 years ago most of the automobile tires were white or red and were good for only about 5,000 miles. Now tires are practically all black and are good for 10,000 to 15,000 miles, results due to the use of carbon black. The increased durability has saved motorists millions of dollars. Carbon black is used in all kinds of rubber, but the use in tires is by far the most important. In 1929 nearly 140,000,000 pounds of carbon black was used in the manufacture of about 70,000,000 tires (casings), indicating a consumption of 2 pounds per tire, or slightly more than in 1928. This increase was undoubtedly due to the fact that the average size of casings was increased in 1929.

The third important use of carbon black is as a coloring agent in paints, varnishes, and lacquers. This use accounted for deliveries of 17,257,000 pounds in 1929, or 9 per cent of the total domestic sales, compared with 20,040,000 pounds in 1928.

Carbon black is also a valuable ingredient in the manufacture of such products as shoe and stove polishes, phonograph records, artificial stone, crayons, and carbon paper. The consumption of carbon black in these products is listed under the term "miscellaneous purposes" in the following table. Total deliveries of carbon black for miscellaneous purposes in 1929 amounted to 8,896,000 pounds, as compared with 14,475,000 pounds in 1928.

Despite the rapid increase in the use of carbon black in rubber and for other purposes, the gain in production over the past few years has outstripped consumption, and stocks held at the plants have assumed material proportions. Thus the stocks as of December 31, 1929, totaled 132,203,000 pounds, as compared with 50,240,000 pounds on hand at the beginning of the year. These stock figures do not account for amounts held in storage by brokers, which are probably appreciable. With production amounting to more than 1,000,000 pounds daily and consumption, including exports, amounting to about 800,000 pounds daily, it would appear that the carbon-black industry should curtail operations at least 20 per cent to effect a balance between supply and demand.

Average carbon black consists of about 90 per cent fixed carbon and 10 per cent volatile matter with less than 0.1 per cent ash. Average natural gas is mainly methane (CH_4), which at atmospheric pressure and 32° F. contains 33.44 pounds of carbon per thousand cubic feet. The average yield of carbon black per thousand cubic feet of gas burned in 1929 was 1.40 pounds; this yield, in comparison with the theoretical yield of 33.44 pounds given above, would seem to indicate that the carbon-black industry is extremely inefficient. This apparent inefficiency is not a fact as no one has thus far discovered a means of materially increasing the yield of carbon black without losing some of the qualities peculiar to carbon black alone and to which it owes a large part of its sales. The "furnace" process of producing carbon black is reported to give yields of 8 to 10 pounds of carbon black per thousand cubic feet of gas, but this high-recovery black is gray and is used principally in rubber. On the other hand, the production of certain blacks used in litho or halftone work requires the consumption of as high as 2,000 cubic feet per pound. As stated above, the average yield of carbon black per thousand cubic feet of gas burned in 1929 amounted to 1.40 pounds; this compares with a recovery of 1.42 pounds in 1928 and 1.38 pounds in 1927. A total of 261,107,000,000 cubic feet of natural gas was burned in the manufacture of carbon black in 1929, an amount equaling about 14 per cent of the total natural gas consumed for all purposes in that year.

There is a growing tendency to treat the gas burned in carbon-black manufacture for natural gasoline before burning. For example, the gas treated for natural gasoline in 1929 before burning was 87 per cent of the total gas consumed for carbon black, whereas only 80 per cent of the total was treated in 1928. All of the gas burned for carbon black in Texas in 1929 was first treated for natural gasoline; hence the major portion of the untreated gas was burned in Louisiana.

Losses of carbon black at plants between the time the production is measured and the time it is shipped amounted to 673,000 pounds in 1929, as compared with 802,000 pounds in 1928, which would seem to indicate an increased efficiency in handling and storing. These losses do not include the very appreciable amount of black that blows into the atmosphere during manufacture. Such losses, however, are being constantly reduced by improvements in the construction of buildings and equipment.

Carbon-black prices have shown extreme fluctuations since the product was first used. Carbon black was sold for as high as $5 per pound soon after its value as a coloring agent in printing ink was discovered, but it was also priced as low as 4 cents per pound immediately after the development of a new process for producing it. The average value at the plants for the year 1929 was 5.11 cents, as compared with 5.54 cents in 1928. The total value amounted to $18,720,000 in 1929, as compared with $13,782,000 in 1928. The above average values correspond roughly to wholesale prices; spot or retail prices, which include freight and brokerage, are approximately double the wholesale prices. The retail price of a common brand of carbon black was quoted as 11 cents per pound on January 1, 1928, and increased to 13 cents before January 1, 1929, but fell to 10.5 cents before January 1, 1930. This reversal in the price trend reflected the difference in the balance between supply and demand for the two years—1928 witnessed a material decline in stocks; 1929, an even greater increase in stocks.

Summary of statistics of carbon black made from natural gas in the United States, 1925–1929

	1925	1926	1927	1928	1929
Number of producers reporting	42	33	33	31	35
Number of plants	63	62	61	65	71
Quantity produced:					
By States—					
Kentucky pounds	7,309,378	6,309,826	5,669,000	484,000	----------
Louisiana do	129,839,907	130,376,987	124,188,000	136,320,000	127,345,000
Texas do	26,219,510	36,328,052	56,396,000	100,828,000	228,183,000
West Virginia do	10,847,794	3,804,586	2,796,000	697,000	578,000
Wyoming do	(1)	(1)	6,294,000	(1)	(1)
Other States do	3,200,789	3,756,725	3,086,000	10,461,000	10,336,000
Total do	177,417,378	180,576,176	198,429,000	248,790,000	366,442,000
By processes—					
Channel process do	143,701,153	152,300,410	167,357,000	220,532,000	327,552,000
Other processes [2] do	33,716,225	28,275,766	31,072,000	28,258,000	38,890,000
Stocks held by producers Dec. 31 do	96,023,448	108,378,101	82,831,000	50,240,000	132,203,000
Losses do	1,433,850	716,813	546,000	802,000	673,000
Quantity sold:					
Domestic—					
To rubber companies do	86,328,826	(3)	(3)	140,938,000	138,474,000
To ink companies do	22,388,807	(3)	(3)	27,223,000	27,350,000
To paint companies do	11,757,601	(3)	(3)	20,040,000	17,257,000
For miscellaneous purposes do	11,973,457	(3)	(3)	14,475,000	8,896,000
Total do	132,448,691	128,294,321	168,999,000	202,676,000	191,977,000
Export do	43,182,635	39,210,389	54,431,000	77,903,000	91,829,000
Total do	175,631,326	167,504,710	223,430,000	280,579,000	283,806,000
Value (at plants) of carbon black produced:					
Total dollars	9,639,585	9,939,221	10,955,000	13,782,000	18,720,000
Average per pound cents	5.43	5.50	5.52	5.54	5.11
Estimated quantity of natural gas used M cubic feet	140,366,000	130,321,000	144,087,000	175,137,000	261,107,000
Average yield per M cubic feet pounds	1.26	1.39	1.38	1.42	1.40

[1] Included under "Other States."
[2] Including disk, Lewis, roller, "special," and thermatomic.
[3] Figures not available.

PRODUCTION BY STATES AND DISTRICTS

The carbon-black industry is dependent upon a supply of cheap gas, and to find such a supply it has had to migrate before the encroachment of the higher priced uses for natural gas. A distinct step in this migration occurred during the last half of 1928, when the center of production moved from Louisiana to Texas. Accordingly, Texas was the leading producing State in 1929 with a total output of 228,183,000 pounds, or 126 per cent above its 1928 output. Of this total, 199,104,000 pounds, or 87 per cent, was produced in the "Panhandle" and 29,079,000 pounds, or 13 per cent, in the general vicinity of Breckenridge, indicating a gain in the relative importance of the Panhandle as a carbon-black producing center. Production in Louisiana, now the second State in importance, totaled 127,345,000 pounds in 1929, as compared with 136,320,000 pounds in 1928. This decrease indicates that the producers in the Monroe field have already begun to be affected by the competition of the large natural-gas pipe lines that tap this field. The production of the remaining carbon-black producing States—Montana, Oklahoma, Utah, West Virginia, and Wyoming—amounted to 10,914,000 pounds in 1929, representing only 3 per cent of the total output, as compared with 5 per cent of the total from "Other States" in 1928. Oklahoma again entered the ranks of the carbon-black producing States; it had not produced since 1924. Kentucky, one of the pioneer States in carbon-black production, had no output in 1929, a further indication of the westward migration of the industry.

Carbon black produced from natural gas in the United States, 1928 and 1929, by States and by major producing districts

State and district	Producers reporting	Number of plants	Production			Estimated quantity of natural gas used (M cubic feet)	Average yield per M cubic feet (pounds)
			Pounds	Value at plant			
				Total	Average (cents)		
1928							
Kentucky	1	1	484,000	$24,000	4.96	218,000	2.22
Louisiana:							
Monroe district (Morehouse, Ouachita, and Union Parishes)	19	31	136,183,000	7,359,000	5.40	104,523,000	1.30
Rest of State (Caddo Parish)	1	1	137,000	7,000	5.11	147,000	.93
Total Louisiana	[1] 20	32	136,320,000	7,366,000	5.40	104,670,000	1.30
Montana	2	2	2,084,000	123,000	5.90	1,760,000	1.18
Texas:							
Breckenridge district (Eastland and Stephens Counties)	8	9	35,901,000	2,268,000	6.32	19,077,000	1.88
Panhandle district (Carson, Gray, Hutchinson, and Wheeler Counties)	9	16	64,927,000	3,438,000	5.30	43,672,000	1.49
Total Texas	[1] 13	25	100,828,000	5,706,000	5.66	62,749,000	1.61
Utah	1	1	(2)	(2)	(2)	(2)	(2)
West Virginia	2	2	697,000	51,000	7.32	494,000	1.41
Wyoming	2	2	(2)	(2)	(2)	(2)	(2)
Undistributed [3]	------	------	8,377,000	512,000	6.11	5,246,000	1.60
Total United States	[1] 31	65	248,790,000	13,782,000	5.54	175,137,000	1.42
1929							
Louisiana: Monroe-Richland district (Morehouse, Ouachita, Richland, and Union Parishes)	20	31	127,345,000	6,731,000	5.29	103,846,000	1.23
Montana	2	2	2,496,000	134,000	5.37	2,142,000	1.17
Oklahoma	1	1	(2)	(2)	(2)	(2)	(2)
Texas:							
Breckenridge district (Eastland and Stephens Counties)	7	8	29,079,000	1,667,000	5.73	14,601,000	1.99
Panhandle district (Carson, Gray, Hutchinson, and Wheeler Counties)	13	25	199,104,000	9,692,000	4.87	136,374,000	1.46
Total Texas	[1] 15	33	228,183,000	11,359,000	4.98	150,975,000	1.51
Utah	1	1	(2)	(2)	(2)	(2)	(2)
West Virginia	2	2	578,000	35,000	6.06	342,000	1.69
Wyoming	1	1	(2)	(2)	(2)	(2)	(2)
Undistributed [3]	------	------	7,840,000	461,000	5.88	3,802,000	2.06
Total United States	[1] 35	71	366,442,000	18,720,000	5.11	261,107,000	1.40

[1] In counting the total number of producers, a producer operating in more than one State, district, or county is counted only once.
[2] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[3] 1928: Utah and Wyoming; 1929: Oklahoma, Utah, and Wyoming.

NUMBER AND CAPACITY OF PLANTS

A total of 71 carbon-black plants and 35 operators reported to the Bureau of Mines for 1929, as compared with 65 plants and 31 operators for 1928. The number of plants in operation in Texas rose from 25 in 1928 to 33 in 1929; Oklahoma gained 1; and Kentucky, Louisiana, and Wyoming each lost 1.

The total daily capacity of the plants operated amounted to 1,442,425 pounds in 1929, as compared with 1,251,450 pounds in 1928, indicating an increase of 15 per cent in capacity during the year.

This increase compares with other increases in capacities over the same period, as follows:

	Per cent
Petroleum refineries	8
Cracking plants	16
Natural-gasoline plants	15

As the average daily production of carbon black during 1929 was 1,004,000 pounds, the total daily capacity of 1,442,425 pounds for that year indicates an excess capacity of about 438,000 pounds or 44 per cent and compares with excess capacities in the refining and natural-gasoline industries of approximately 45 and 75 per cent, respectively.

Changes of particular interest that occurred among the producing plants in 1929 were the construction of plants in Oklahoma and in the Richland field southeast of Monroe, La.—the first in the Richland area—and the closing down of the single plant in Kentucky and that in Caddo Parish, La.

Number and daily capacity of carbon-black plants in the United States, 1928 and 1929, by counties or parishes

State	County or parish	Number of plants		Total daily capacity (pounds)	
		1928	1929	1928	1929
Kentucky	Green	1	(1)	5,000	(1)
Louisiana	Caddo	1	(1)	5,000	(1)
	Morehouse	8	8	98,525	97,400
	Ouachita	22	21	334,175	333,675
	Richland	(2)	1	(2)	15,000
	Union	1	1	19,500	19,500
		32	31	457,200	465,575
Montana	Fallon	1	1	4,000	4,000
	Stillwater	1	1	5,000	5,000
		2	2	9,000	9,000
Oklahoma	Seminole	(2)	1	(2)	(3)
Texas	Carson	2	2	81,500	86,800
	Eastland	2	2	12,250	12,250
	Gray	5	8	210,000	276,400
	Hutchinson	7	12	215,000	437,000
	Stephens	7	6	219,600	92,400
	Wheeler	2	3	11,400	24,000
		25	33	749,750	928,850
Utah	Grand	1	1	(3)	(3)
West Virginia	Logan	1	1	2,000	2,000
	Ritchie	1	1	1,500	1,500
		2	2	3,500	3,500
Wyoming	Fremont	1	(1)	(3)	(1)
	Niobrara	1	1	(3)	(3)
		2	1	(3)	(3)
Undistributed [4]				27,000	35,500
United States		65	71	1,251,450	1,442,425

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[1] Closed down before Jan. 1, 1929.
[2] Built during 1929.
[3] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[4] 1928: Utah and Wyoming; 1929: Oklahoma, Utah, and Wyoming.

PRODUCERS

Carbon-black producers of the United States, as of January 1, 1930

State and company	County	Nearest town	Process
Louisiana:			
Carson Carbon Co., Post Office Box 880, Cincinnati, Ohio.	Morehouse	Collinston	Channel.
Century Carbon Co., Monroe, La	Ouachita	Swartz	Do.
Coltexo Corporation, 45 East Forty-second Street, New York, N. Y.	do	Hammock	Do.
J. Smylie Herkness, Route No. 3, Bastrop, La	Morehouse	Bastrop	Do.
J. M. Huber Co. of Louisiana (Inc.), 460 West Thirty-fourth Street, New York, N. Y.	Ouachita	Swartz	Do.
Imperial Oil & Gas Products Co., 1104 Union Bank Building, Pittsburgh, Pa.	do	Sterlington	Do.
International Gas Products (Inc.), 411 Bernhardt Building, Monroe, La.	Richland	Archibald	Do.
Interstate Natural Gas Co. (operated by Columbian Carbon Co., trustee), 45 East Forty-second Street, New York, N. Y.	Union	Spencer	Do.
Keystone Carbon Co., Monroe, La	Ouachita	Monroe	Do.
Monroe-Louisiana Carbon Co., 45 East Forty-second Street, New York, N. Y.	do	Hancock	Lewis.
New Process Carbon Black Co., Monroe, La	do	Monroe	Channel.
North America Carbon Co., 301 Ardis Building, Shreveport, La.	do	Swartz	Do.
Peerless Carbon Black Co., 1709 First National Bank Building, Pittsburgh, Pa.	do	Bourland	"Special."
Southern Carbon Co., 45 East Forty-second Street, New York, N. Y.	Morehouse	Perryville	Channel.
	do	Spyker	Do.
	Ouachita	Fairbanks	Do.
	do	Fowler	Do.
	do	Swartz	Do.
Texas-Louisiana Producing & Carbon Co., Post Office Box 181, Monroe, La.	do	Not reported (2 plants).	Do.
Thermatomic Carbon Co., 108 Ferry Street, Pittsburgh, Pa.	do	Sterlington	Thermatomic.
Tire Carbon Co., Post Office Box 11, Shreveport, La.	do	Swartz	Channel.
Union Gas Products Co., 714 Ouachita Bank Building, Monroe, La.	do	do	Light channel.
United Carbon Co., Post Office Box 1475, Charleston, W. Va.	Morehouse	Bastrop	Channel.
	do	Dewdrop	Do.
	do	Humphreys	Do.
	Ouachita	Cargas	Do.
	do	Phillips	Do.
	do	Swartz (2 plants)	Do.
U. S. Carbon Co., Bastrop, La	Morehouse	Bastrop	Do.
Montana:			
Crystal Carbon Co. (United Carbon Co., owner), Post Office Box 1475, Charleston, W. Va.	Stillwater	Molt	Do.
Gas Products Co., Baker, Mont	Fallon	Baker	Do.
Oklahoma:			
Cabot Carbon Co., 940 Old South Building, Boston, Mass.	Seminole	Not reported	Do.
Texas:			
Cabot Carbon Co., 940 Old South Building, Boston, Mass.	Gray	Pampa	Do.
	Hutchinson	Wewauka	Do.
Cabot Co., 940 Old South Building, Boston, Mass.	Carson	Skellytown	Channel and roller.
Coltexo Corporation, 45 East Forty-second Street, New York, N. Y.	Gray	Lefors	Channel.
	Stephens	Parks	Do.
Crescent Carbon Co., Borger, Tex	Hutchinson	Borger	Do.
Eastern Carbon Black Co. (United Carbon Co., owner), Post Office Box 1475, Charleston, W. Va.	do	Borger (3 plants)	Do.
	do	Borger	Channel and disk.
General Atlas Chemical Co., Pampa, Tex	Gray	Pampa	"Special."
J. M. Huber Co. of Louisiana (Inc.), 460 West Thirty-fourth Street, New York, N. Y.	Hutchinson	Borger	Channel.
Kosmos Carbon Co. (United Carbon Co., owner), Post Office Box 1475, Charleston, W. Va.	do	Borger (2plants)	Do.
Magnolia Petroleum Co., Dallas, Tex	Carson	Skellytown	Do.
	Gray	Pampa	Do.
	Stephens	Breckenridge	Do.
	Wheeler	Lela	Do.
Palmer Carbon Co., Post Office Box 11, Shreveport, La.	Hutchinson	Borger	Do.
Panhandle Carbon Co., Post Office Box 11, Shreveport, La.	do	do	Do.
Peerless Carbon Black Co., 1709 First National Bank Building, Pittsburgh, Pa.	Eastland	Pioneer	"Special."
Texas Carbon Industries (Inc.), Post Office Box 50, Breckenridge, Tex.	Stephens	Breckenridge (2 plants).	Channel.

Carbon-black producers of the United States, as of January 1, 1930—Continued

State and company	County	Nearest town	Process
Texas—Continued.			
Texas Elf Carbon Co., 940 Old South Building, Boston, Mass.	Gray	Pampa	Channel.
	Stephens	Eliasville	Do.
Western Carbon Co., 45 East Forty-second Street, New York, N. Y.	Eastland	Pioneer	Do.
	Gray	Kings Mill	Do.
	do	Lefors	Do.
	do	Pampa	Do.
	Hutchinson	Borger	Do.
	Wheeler	Lela	Do.
	do	Magic City	Do.
Utah: Crystal Carbon Co. (United Carbon Co., owner), Post Office Box 1475, Charleston, W. Va.	Grand	Cisco	Do.
West Virginia:			
Columbian Carbon Co., 45 East Forty-second Street, New York, N. Y.	Logan	Chapmanville	Do.
Imperial Oil & Gas Products Co., 1104 Union Bank Building, Pittsburgh, Pa.	Ritchie	Hannahdale	Do.
Wyoming: J. M. Huber Co. of Louisiana (Inc.), 460 West Thirty-fourth Street, New York, N. Y.	Niobrara	Manville	Do.

EXPORTS

The export trade in carbon black continued to expand in 1929; in fact, a total of approximately 91,829,000 pounds was shipped to foreign countries, comparing with shipments of 77,903,000 pounds in 1928, a gain of 18 per cent. The 1929 exports were valued at nearly $8,271,000, an average of 9 cents per pound as compared with 8.7 cents in 1928. Exports of carbon black to the majority of the countries showed an increase in quantity in 1929. The United Kingdom continued to be the leading carbon-black customer and was again followed in order by France, Germany, and Canada.

Carbon black exported from the United States, 1927–1929, by countries

Country	1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value
Australia	2, 624, 908	$238, 083	3, 384, 455	$299, 112	5, 705, 833	$510, 526
Belgium	988, 363	84, 282	1, 212, 626	106, 742	2, 260, 152	196, 946
Canada	8, 988, 589	638, 560	11, 636, 500	794, 925	13, 890, 749	975, 002
China	598, 914	49, 586	1, 153, 575	96, 153	1, 049, 680	97, 417
France	9, 796, 750	833, 980	14, 595, 631	1, 378, 392	16, 698, 430	1, 708, 131
Germany	9, 299, 871	837, 418	13, 432, 720	1, 176, 069	14, 049, 753	1, 363, 124
Italy	3, 158, 463	275, 491	3, 439, 691	312, 150	2, 544, 267	239, 907
Japan	3, 257, 831	288, 395	5, 549, 962	483, 450	5, 113, 956	469, 511
Netherlands	1, 102, 116	100, 581	1, 947, 333	175, 707	2, 006, 238	188, 991
United Kingdom	13, 200, 486	1, 116, 402	18, 887, 337	1, 721, 199	23, 273, 769	2, 068, 911
Other	1, 414, 520	136, 956	2, 663, 323	250, 325	5, 236, 388	452, 371
	54, 430, 811	4, 599, 734	77, 903, 153	6, 794, 224	91, 829, 215	8, 270, 837

FULLER'S EARTH[1]

By Jefferson Middleton

GENERAL CONDITIONS

The fuller's earth industry continued to show progress in 1929; the product sold or used by producers in the United States increased in both quantity and value. The output of 1929—315,983 short tons, valued at $4,309,723—was reported by 17 operators, the same number that reported for 1928. Both quantity and value of output were the largest ever recorded. The increase in quantity compared with 1928 was 10 per cent and that in value 11 per cent. The average value per ton in 1929 was $13.64, an increase of 7 cents compared with 1928. The quantity and value of fuller's earth imported increased 9 and 15 per cent, respectively, compared with 1928.

The apparent consumption of fuller's earth in the United States in 1929 was about 303,000 tons. The domestic earth used constituted 97 per cent of this total.

OCCURRENCE

Occurrences of fuller's earth have been reported in Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New York, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Virginia, and Washington, but in 1929 it was produced only in Colorado, Florida, Georgia, Illinois, Massachusetts, Nevada, and Texas.

USES

Fuller's earth is used mainly as a filtering medium in clarifying or bleaching fats, greases, and mineral and vegetable oils. Its original use was in fulling woolen cloth, and from that it derived its name, but such use, at least in this country, has almost been abandoned.

To within the past few years the term "fuller's earth" has been applied only to claylike materials that possess the property of bleaching, clarifying, decolorizing, or filtering mineral and vegetable oils and animal fats and greases. However, material discovered in recent years in the far West, which is of a different character but is said to be of excellent quality for filtering or clarifying oils, has been included in the figures in this report.

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[1] Work on manuscript completed July, 1930.

HISTORY

Fuller's earth was first discovered in the United States in 1891 near Alexander, Ark., by John Olsen. The mineral was used for a time by the Southern Cotton Oil Co., at Little Rock, Ark., but its use was finally abandoned.[2] The real beginning of the industry in this country, however, was in 1893, near Quincy, Fla., when quite by accident, in an unsuccessful effort to burn brick on the property of the Owl Cigar Co., an employee called attention to the close resemblance between the clay used and the German fuller's earth. This discovery in Florida caused considerable excitement, and deposits of fuller's earth were reported from a number of States, but the material in most of these deposits was found to have no value as fuller's earth. Production began in Florida almost immediately after the discovery, and from 1897 to 1899 fuller's earth was produced in Florida, Colorado, New York, and Utah. Florida maintained its rank as the leading producer continuously until 1924. In 1901 Arkansas again became a producer. From 1904 to 1907 Arkansas was the second largest producer, but no production of fuller's earth has been reported from Arkansas since 1922. Fuller's earth was found in Georgia soon after the discovery in Florida, but Georgia did not become a producer until 1907, when it ranked third as a producing State; it ranked second from 1909 to 1923, except in 1918 and 1919 when Texas was second; and since 1924 it has ranked first. In 1904 Alabama and Massachusetts, in 1907 South Carolina and Texas, in 1909 California, in 1918 Nevada, in 1922 Illinois and Pennsylvania, and in 1927 Arizona first appeared as producers. South Carolina has reported no fuller's earth since 1913, California none since 1926, and Pennsylvania none since 1922. Colorado reappeared as a producer of fuller's earth in 1928. Arizona reported no production for 1929.

PRODUCTION

Fuller's earth sold or used by producers in the United States, 1920–1929

Year	Operators reporting sales	Short tons	Value at mines		Year	Operators reporting sales	Short tons	Value at mines	
			Total	Average				Total	Average
1920	12	128, 487	$2, 506, 189	$19. 51	1925	14	206, 574	$2, 923, 965	$14. 15
1921	12	105, 609	1, 973, 848	18. 69	1926	14	234, 152	3, 356, 482	14. 33
1922	15	138, 944	2, 289, 719	16. 48	1927	16	264, 478	3, 767, 038	14. 24
1923	15	149, 134	2, 247, 523	15. 07	1928	17	287, 012	3, 895, 991	13. 57
1924	13	177, 994	2, 632, 342	14. 79	1929	17	315, 983	4, 309, 723	13. 64

The small number of producers in most of the States makes it impossible to publish totals for these States without revealing confidential data. The output increased in quantity in every State reporting sales in 1929 except Nevada, and in value in every State except Nevada and Texas. The South continues to lead in the production of fuller's earth, Georgia, Florida, and Texas, named in the order of their relative importance, reporting 76 per cent of the total output in 1929, compared with 73 per cent in 1928. In 1929, as in the preceding five years, Georgia was the leading State in quantity and value. Florida was again second and Nevada again third. These three States reported 78 per cent of the total in 1929. The only States for which figures for both 1928 and 1929 may be shown without disclosing confidential information are Nevada and Texas. The output in Nevada in 1929 was 38,381 tons, valued at $346,702, or $9.03 a ton, a decrease of 15 per cent in quantity and 22 per cent in total value, as compared with 1928. The quantity of fuller's earth sold or used by producers in Texas in 1929 was 34,249 tons, valued at $322,215, or $9.41 a ton, compared with 33,388 tons, valued at $338,080, or $10.13 a ton, in 1928, an increase in quantity of 3 per cent but a decrease in value of 5 per cent.

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[2] Branner, J. C., An Early Discovery of Fuller's Earth in Arkansas: Trans. Am. Inst. Min. Eng., vol. 43, 1913, pp. 520–522.

The following table shows the output of fuller's earth in 1927, 1928, and 1929, by uses, as reported by producers:

Fuller's earth sold or used by producers in the United States, 1927–1929, by uses

Year	Bleaching, clarifying, decolorizing, or filtering—				Miscellaneous uses		Total (short tons)
	Mineral oils		Vegetable oils and animal fats				
	Short tons	Percentage of total	Short tons	Percentage of total	Short tons	Percentage of total	
1927	243, 009	91. 9	15, 363	5. 8	6, 106	2. 3	264, 478
1928	258, 645	90. 1	24, 288	8. 5	4, 079	1. 4	287, 012
1929	301, 607	95. 4	10, 685	3. 4	3, 691	1. 2	315, 983

IMPORTS AND EXPORTS

Imports of fuller's earth, which at one time constituted the entire supply, were increasing before the World War and reached their maximum in 1914; since that time the general trend has been downward. Of the 10 years covered by the following table, 1920, 1922, 1925, and 1926 showed increases; imports were practically the same in 1927 as in 1928; and in 1929 there was a considerable increase in quantity—9 per cent—and a still greater increase in value—15 per cent—as compared with 1928. The quantity in 1929 was only one-third of that in 1914. In 1929 wrought or manufactured earth constituted 93 per cent of the total quantity and 92 per cent of the total value of fuller's earth imported.

Exports of fuller's earth are not shown in the official records of the foreign commerce of the United States, but 7 operators reported to the Bureau of Mines that in 1929 they exported 21,264 short tons of fuller's earth to Argentina, Belgium, Canada, Cuba, England, France, Germany, Ireland, Mexico, Rumania, Russia, Scotland, and Turkey. This is an increase of 29 per cent over 1928 and is the largest quantity ever reported by producers as having been exported.

Fuller's earth imported for consumption in the United States, 1920–1929 [1]

Year	Unwrought or unmanufactured		Wrought or manufactured		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	1, 518	$19, 793	17, 497	$202, 100	19, 015	$221, 893
1921	483	6, 172	9, 261	113, 243	9, 744	119, 415
1922	607	7, 413	9, 962	128, 282	10, 569	135, 695
1923	642	8, 252	7, 905	105, 692	8, 547	113, 944
1924	296	3, 385	7, 006	89, 103	7, 302	92, 488
1925	215	2, 619	7, 800	108, 676	8, 015	111, 295
1926	158	2, 290	8, 940	121, 384	9, 098	123, 674
1927	550	5, 679	7, 030	103, 602	7, 580	109, 281
1928	354	6, 710	7, 239	125, 293	7, 593	132, 003
1929	608	11, 583	7, 694	140, 849	8, 302	152, 432

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[1] Compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

ABRASIVE MATERIALS[1]

By Oliver Bowles[2]

INTRODUCTION

Manufacturing processes and machinery involve a very extensive use of abrasive materials for grinding and polishing. As many different mineral products are thus used it is desirable to group them under a single heading. Some of the products are used for purposes other than polishing or grinding, but the statistics given herein for each material are confined as far as possible to that part of the output that properly enters into the abrasive industries. For example, only a small part of the sandstone production (including grindstones, pulpstones, whetstones, etc.) can be classed as abrasive material, the great bulk of the production being used in the building industries; the figures for abrasive sandstone, however, are easily segregated for inclusion in this report. On the other hand, it has not been possible to make a separation by uses for diatomite, tripoli, and pumice, so the entire output of these products is included in the figures for abrasives. Both feldspar and quartz are used as abrasives, but the quantity so used is relatively small and can not be determined with any degree of accuracy; these minerals are therefore considered in the chapters of Mineral Resources entitled " Feldspar " and " Silica."

Abrasive materials fall into two distinct groups designated as natural abrasives and artificial abrasives. In the first group are such products as emery or garnet used in the manufacture of coated abrasive papers and black diamonds used as cutting agents in saws for cutting stone and in core drills. Natural abrasives include minerals applied to grinding purposes in the form in which they occur in nature, subject only to such processes as shaping, sizing, separation from impurities, or bonding into suitable forms. In the second group are manufactured products such as carborundum and steel shot. Artificial abrasives are synthetic compounds, most of them products of the electric furnace.

This report deals particularly with natural abrasives. Their production includes a number of widely scattered dissimilar enterprises engaged in placing various products on the market. According to present-day standards of mining and manufacture, few, if any, of these enterprises would be considered large. Nevertheless, individually as well as collectively, they are important elements in the industrial life of the country inasmuch as they supply not only the tools for grinding, polishing, and other abrasive operations but also the ingredients of cleansing compounds, without which the great wood, leather, glass, metal-working, and other industries, as well as many householders, would be put to great expense and inconvenience in the use of substitutes.

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[1] Work on manuscript completed July, 1930.

[2] Figures on production compiled by Miss A. T. Coons and Miss A. E. Davis, of the Bureau of Mines. Data on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Artificial abrasives are finding very wide use and are employed as substitutes for natural abrasives for many applications. Therefore, they are considered briefly in this report for purposes of comparison and because of their strong influence on the marketing of the natural products.

NATURAL ABRASIVES

Under the head of natural abrasives in this report are included millstones and related quarry products, such as chasers, dragstones, and paving stone for chaser mills; grindstones and pulpstones; oilstones and other whetstones, hones, scythestones, and rubbing stones; corundum and emery; abrasive garnet; tripoli; diatomite (diatomaceous earth); pumice; and pebbles for grinding and lining for tube mills. These natural abrasives were produced in 1929 in 25 States, as follows:

Arizona	Pumice.
Arkansas	Oilstones and tripoli.
California	Diatomite, grinding pebbles, and pumice.
Florida	Diatomite.
Illinois	Tripoli.
Indiana	Rubbing stones and whetstones.
Kansas	Pumice.
Maryland	Diatomite.
Michigan	Grindstones.
Minnesota	Grinding pebbles and tube-mill lining.
Missouri	Tripoli.
Nebraska	Pumice.
Nevada	Diatomite.
New Hampshire	Diatomite and garnet.
New York	Diatomite, emery, garnet, and millstones.
North Carolina	Millstones.
Ohio	Grindstones, pulpstones, rubbing stones, scythestones, and whetstones.
Oklahoma	Tripoli.
Oregon	Diatomite and pumice.
Pennsylvania	Rottenstone.
Tennessee	Tripoli.
Vermont	Scythestones.
Virginia	Diatomite, emery, and millstones.
Washington	Diatomite, pulpstones, and rubbing stones.
West Virginia	Grindstones and pulpstones.

MILLSTONES

The value of the millstones or burrstones and related quarry products—chasers, dragstones, and pavers—sold by producers in the United States in 1929 was $31,407, a decrease of 27 per cent from 1928. During the past nine years Ulster County, N. Y., has been the principal source of output, and the largest number of producers reported from that region.

American millstones have been and are still for the most part made of quartz sandstone and conglomerate, chiefly in Ulster County, N. Y., and Montgomery County, Va. Millstones are also made of granite, particularly in Alabama, Maine, Minnesota, New Hampshire, and North Carolina. The production recorded in Mineral Resources includes only the stones made for other than purely local use. Doubtless a large number of stones have been made in many unrecorded localities as local use has required, and they have been made of other rocks than those specified, particularly in the mountain sections of the Southern States. Formerly the millstone manufacturing industry was much larger than at present. About 1880 the total value of the stones produced and sold in the United States was around $200,000 annually. The production has declined since the late eighties and during the last nine years has been less than $50,000 worth of stones annually. The decline is due in part to the fact that the manufacture of millstones is a handcraft in which, as in many others in the United States, the old master craftsmen, who are gradually disappearing, are not being replaced. In part, also, the change is due to new processes in the grain, paint, and mineral milling industries in which the old-style burrstones and chaser mills are being supplanted by grinding equipment of an entirely different type.

Value of millstones, chasers, and dragstones sold by producers in the United States, 1920–1929

Year	New York		Other States [1]		Total	
	Producers	Value	Producers	Value	Producers	Value
1920	8	$13, 331	11	$49, 994	19	$63, 325
1921	12	14, 672	7	9, 852	19	24, 524
1922	12	17, 025	4	3, 828	16	20, 853
1923	17	14, 344	4	7, 885	21	22, 229
1924	17	18, 215	5	11, 910	22	30, 125
1925	13	14, 063	5	8, 427	18	22, 490
1926	12	23, 629	7	22, 308	19	45, 937
1927	12	26, 015	5	9, 423	17	35, 438
1928	14	26, 224	6	16, 662	20	42, 886
1929	11	18, 147	5	13, 260	16	31, 407

[1] 1920: Alabama, Maryland, North Carolina, and Virginia; 1921: Alabama, New Hampshire, North Carolina, and Virginia; 1922: Alabama, North Carolina, and Virginia; 1923: Maine, Minnesota, North Carolina, and Virginia; 1924–1928: New Hampshire, North Carolina, and Virginia; 1929: North Carolina and Virginia.

GRINDSTONES AND PULPSTONES

Grindstones and pulpstones are made from sandstone quarried in northeastern Ohio, western West Virginia, eastern Michigan, and in Pierce County, Wash. The total output of such stones in the United States in 1929 was 27,736 short tons, valued at $1,241,546, a decrease of 16.6 per cent in quantity and 18 per cent in value compared with 1928. As may be noted from the following table, which shows the production over a period of years, the tonnage of grindstones produced has gradually declined, undoubtedly because of the substitution of manufactured abrasive wheels for the natural stones. Segmental pulpstones, which are constructed of artificial abrasives and attached to a core of concrete or metal, are finding increasing use as substitutes for natural pulpstones.

Grindstones and pulpstones sold by producers in the United States, 1920–1929

Year	Grindstones		Pulpstones		
	Short tons	Value	Pieces	Short tons	Value
1920	44,832	$1,239,990	2,321	8,652	$467,014
1921	16,310	477,259	2,941	10,030	750,063
1922	21,367	574,900	[1] 1,619	[1] 5,157	[1] 445,286
1923	37,384	1,008,899	2,533	9,186	680,416
1924	28,991	852,260	2,660	9,193	814,409
1925	28,970	864,637	2,530	8,370	841,302
1926	28,669	875,240	2,804	9,670	997,994
1927	23,222	633,207	2,707	8,709	921,543
1928	24,222	606,408	2,461	9,016	902,429
1929	21,071	617,618	1,834	6,665	623,928

[1] Exclusive of sales in Washington prior to 1923.

The companies producing grindstones and pulpstones in the United States in 1929, with the locations of the deposits from which the stone was obtained, were as follows:

MICHIGAN

Huron County: Grind Stone City—The Cleveland Quarries Co. (successor to The Cleveland Stone Co.) (address, Cleveland, Ohio); grindstones.

OHIO

Cuyahoga County: Berea—The Cleveland Quarries Co. (successor to The Cleveland Stone Co.) (address, Cleveland); grindstones, lathe stones.
Holmes County:
  Glenmont—The Briar Hill Stone Co.; grindstones.
  Killbuck—Mount Pisbia Stone Co. (address, Elgin); grindstones.
Jefferson County:
  Empire—Smallwood Stone Co. (address, Steubenville); pulpstones.
  Hammondsville—The International Pulpstone Co. (address, Elyria); pulpstones.
Lorain County:
  Amherst—The Cleveland Quarries Co. (successor to The Cleveland Stone Co. and The Ohio Quarries Co.) (address, Cleveland); grindstones.
  Columbia Station—Columbia Stone Co.; grindstones.
  Kipton—The Nicholl Stone Co. (address, Lorain); grindstones.
Washington County:
  Constitution—The Constitution Stone Co.; grindstones.
  Marietta—
    The Cleveland Quarries Co. (successor to The Cleveland Stone Co.) (address, Cleveland); grindstones.
    The Eureka Stone Co.; grindstones.
    The Hall Grindstone Co.; grindstones.
    Ohio Valley Stone Co.; grindstones.

WASHINGTON

Pierce County: Wilkeson—Walker Cut Stone Co. (address, Tacoma); pulpstones.

WEST VIRGINIA

Boone County: Jeffery—The International Pulpstone Co. (address, Elyria Ohio); pulpstones.
Jackson County: Sherman—The Eureka Stone Co. (address, Marietta, Ohio); grindstones.

Monongalia County:
- Fairmont (near)—The Smallwood-Low Stone Co. (address, Fairmont); pulpstones.
- Little Falls—The West Virginia Pulpstone Corporation (address, Cleveland, Ohio); pulpstones.
- Opekiska—
  - The General Stone Co. (address, Amherst, Ohio); pulpstones.
  - Smallwood Stone Co. (address, Steubenville, Ohio); pulpstones.
- Uffington—Uffington Stone Co.; pulpstones.

Pleasants County: St. Marys—Ohio Valley Stone Co. (address, Marietta, Ohio); grindstones.

Wetzel County: Littleton—American Stone Co.; grindstones and pulpstones.

OILSTONES AND OTHER WHETSTONES, SCYTHESTONES, RUBBING STONES, ETC.

Natural stone or quarry products used as abrasive material include, besides the millstones, grindstones, and pulpstones above considered, oilstones and other whetstones, hones, rubbing stones, and scythestones. These are cut or otherwise shaped, usually in small pieces, in a great variety of forms for the special uses indicated by their names. Oilstones are produced in the United States from novaculite quarried in Arkansas; other whetstones chiefly from sandstone quarried in Indiana and Ohio; scythestones from sandstone quarried in Indiana and Ohio and from schist quarried in Vermont; and rubbing stones from sandstone quarried in Indiana, Ohio, and Washington.

Oilstones and other whetstones, hones, scythestones, and rubbing stones sold by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	1,144	$231,747	1925	970	$272,224
1921	831	173,025	1926	1,680	223,359
1922	1,016	197,450	1927	1,048	233,545
1923	1,223	231,812	1928	956	228,245
1924	1,056	258,943	1929	838	212,017

The manufacturers of oilstones and other whetstones, scythestones, and rubbing stones from natural stone in 1929 and the sources of their raw materials were as follows:

The American Rubbing Stone Co., Cincinnati, Ohio: Whetstones and rubbing stones; manufactured from sandstone quarried at Floyds Knobs, Floyd County, Ind.

The Bracher Co., Belleville, N. J.: Oilstones; manufactured from novaculite obtained from quarries near Hot Springs, Garland County, Ark.

J. A. Chaillaux, West Baden, Ind.: Scythestones; manufactured from sandstone quarried at McDermott, Scioto County, Ohio. Stone also sold to other companies for the manufacture of whetstones.

The Cleveland Quarries Co. (successor to The Cleveland Stone Co.), Cleveland, Ohio: Scythestones, lathe stones, and holystones; manufactured from stone obtained at Berea, Cuyahoga County, and Amherst, Lorain County, Ohio.

Garland Whetstone & Realty Co., Hot Springs, Ark.: Produces rough stone, in Garland County, for oilstones, some of which is shipped abroad and some sold to manufacturers in this country.

Pike Manufacturing Co., Pike, N. H.:
- Oilstones; manufactured from novaculite obtained from quarries near Hot Springs, Garland County, Ark.
- Whetstones; manufactured from sandstone obtained from quarries near West Baden, Orange County, Ind., and McDermott, Scioto County, Ohio.

Scythestones; manufactured from schist quarried at Barton, Orleans County, Vt.

Western Quarry Co., Tenino, Wash.: Holystones; manufactured from sandstone quarried at Tenino, Thurston County, Wash.

CORUNDUM AND EMERY

Corundum, the natural aluminum oxide (Al_2O_3), is a mineral exceeded only by the diamond in hardness. The purest form of corundum has excellent abrasive qualities. In the past it has been used extensively as an abrasive but recently has been supplanted almost entirely by the artificial aluminum oxide abrasives. Production in the United States was reported for 1906 and a number of preceding years and again in 1917 and 1918, but no production has been reported since 1918.

Emery is simply a mixture of corundum and magnetite. The best varieties consist of 50 to 60 per cent of corundum and 40 to 50 per cent of magnetite; the more impure varieties contain various amounts of spinel, hematite, and other minerals; the corundum is the important abrading agent. Emery is used principally in the metal trades, where, however, it is being replaced by artificial abrasives to a great extent. The best foreign emery is obtained from the Greek island Naxos. Greece and Turkey are the chief sources of foreign supply. Imports were considerably greater during 1929 than in 1928.

Emery sold or used by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	2,327	$21,685	1925	769	$5,907
1921	305	2,250	1926	386	3,641
1922	1,468	17,511	1927	506	5,855
1923	2,286	29,478	1928	1,341	16,787
1924	2,195	19,756	1929	924	10,722

The companies reporting sales of emery in the United States in 1929, with the locations of the deposits from which the material was obtained, follow. The Pittsylvania (Va.) deposits were not operated in 1929, but sales were made from stock left over from the 1928 operations of the Niagara Emery Mills (Inc.) which went out of business in November, 1929.

NEW YORK

Westchester County:
  Peekskill (near)—
    Keystone Emery Mills (address, 4329 Paul Street, Frankford, Philadelphia, Pa.).
    Smith & Ellis (address, Peekskill).

VIRGINIA

Pittsylvania County: Chatham—Niagara Emery Mills (Inc.) (address, 4329 Paul Street, Frankford, Philadelphia, Pa.).

GARNET

Garnet is a complex silicate mineral or, more properly, a group of minerals varying somewhat in composition and properties. The iron-aluminum garnet, almandite, is the one most commonly used as an abrasive. Garnet is somewhat harder than quartz, and the nature of its fracture is such that the broken particles have enough flat surfaces to permit firm attachment to a paper backing and at the same time expose very efficient cutting edges. About 90 per cent of the garnet mined is used for the manufacture of abrasive papers and cloths which have a higher cutting efficiency than sandpaper. Powdered garnet is used for grinding purposes, particularly for the grinding of plate glass.

The chief production of garnet in the United States is from Warren County, N. Y. Merrimack County, N. H., has been second in importance in recent years. The garnet of the former locality occurs as crystals scattered throughout a granite gneiss and constitutes 4 to 8 per cent of the rock. The rock is quarried by open-pit methods, passed through crushers and rolls, and the garnet separated from the waste rock by jigs and tables.

In 1929 the sales of abrasive garnet by producers in the United States amounted to 5,961 short tons, valued at $435,420. The average value of garnet mined in 1929 was $73 a ton, as compared with $69 in 1928, $83 in 1927, and $82 in 1926.

Abrasive garnet sold or used by producers in the United States, 1920–1929

Year	Short tons	Value
1920	5, 476	$434, 425
1921	3, 048	260, 687
1922	7, 054	566, 879
1923	9, 006	688, 437
1924	8, 290	674, 176
1925	8, 429	$712, 853
1926	6, 397	523, 875
1927	6, 939	573, 525
1928	6, 617	459, 307
1929	5, 961	435, 420

The companies producing garnet in the United States in 1929, with the locations of the deposits from which the garnet was obtained, were as follows:

NEW HAMPSHIRE

Merrimack County:
  Danbury—Ford Motor Co. (address, Detroit, Mich.).
  South Danbury—Wausau Abrasives Co. (address, Wausau, Wis.).

NEW YORK

Warren County:
  North Creek—
    Barton Mines Corporation.
    North River Garnet Co.; made sales from stock on hand; operations discontinued.
  Riparius (Johnsburg)—Warren County Garnet Mills (address, 149 Orange Street, Newark, N. J.).

TRIPOLI

Tripoli is an extremely fine-grained porous form of silica of the chalcedony variety. Some authorities believe that it was formed by decomposition of siliceous limestones, but others question this mode of origin. Most of the tripoli mined is applied to uses other than abrasive. Its most important abrasive use is as a constituent of buffing compounds. It is also used in metal pastes and polishes and in rubs and polishes for paint and lacquer finishes. It is a constituent of various scrubbing and scouring powders and soaps and is said to have superior qualities for cleaning tile floors, woodwork, and kitchen appliances.

Rottenstone is a material related to tripoli but is somewhat more earthy and less siliceous. It is usually regarded as residual matter from the natural decomposition of argillaceous rocks or of impure limestone. It is produced in Lycoming County, Pa., and it is imported from Europe. In Europe it is mined in Derbyshire (England), in Wales, and in Belgium and is used more extensively there than in America. In England it is used as one of the abrasive bases in pastes and liquid metal polishes. In America it is used as a mild abrasive in wood and metal finishing, as, for example, in the scouring of metal surfaces prior to plating.

The value of tripoli sold (including Pennsylvania " rottenstone ") in 1929, as reported by producers, was $545,658. This value corresponds approximately to 38,000 short tons of material, of which about one-fifth was sold in the form of crude quarry products. Most of the production, however, was sold in ground or otherwise prepared form by the producers at values ranging from $10 to $24 a ton.

The chief sources of production in 1929, as in previous years, were a small area lying in Newton County, Mo., and Ottawa County, Okla., and the Alexander-Union County area in southern Illinois; an appreciable output was also reported from Tennessee, and a smaller output was reported from Arkansas. The output of rottenstone in Lycoming County, Pa., is also included in the figures here presented.

Some of the Missouri-Oklahoma tripoli is produced primarily for use as an abrasive, and some of it is mined to be worked up into filter blocks, the cuttings and waste from the making of which are ground and prepared for abrasive and other uses. The larger part of the Missouri output is used as filler, for foundry facings, and in many other ways. The Illinois product is generally known simply as " silica," and although used to some extent as an abrasive for metal polishes, in soaps, and in cleansers, it is very largely used in paint and fillers, in making glass, in the body and enamel of ceramic wares, and for facing foundry molds.

It is not possible to determine the amounts of tripoli used as abrasive material and otherwise nor to obtain from the producers uniform reports on the quantity and value of the crude or rough quarried material, as they sell much of the product originally in some manufactured or prepared form. Statistics herein reported and in earlier chapters of Mineral Resources therefore do not permit satisfactory comparison between years or between producing States. In the following table the value for the total output of crude tripoli is in part an arbitrarily assigned value, inasmuch as a large part of the output is not sold crude but in ground or other prepared form by the original producers. The values given "as sold" are the total realizations as reported by producers and include receipts from sales of both crude and ground or otherwise finished material.

Tripoli (including Pennsylvania "rottenstone") sold or used by producers in the United States, 1920–1929

Year	Illinois			Other States [1]			Total		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Crude (estimated)	As sold (crude and finished)		Crude (estimated)	As sold (crude and finished)		Crude (estimated)	As sold (crude and finished)
1920	24,458	$66,509	$360,651	15,775	$97,567	$209,026	40,233	$164,076	$569,677
1921	7,765	27,333	125,352	4,575	26,559	87,661	12,340	53,892	213,013
1922	18,747	54,741	194,371	11,458	50,568	122,357	30,205	105,309	316,728
1923	11,522	31,230	117,201	15,560	30,960	265,556	27,082	62,190	382,757
1924	13,466	23,566	116,188	15,010	31,971	273,221	28,476	55,537	389,409
1925	11,809	27,480	143,859	17,579	31,290	291,027	29,388	58,770	434,886
1926	11,948	29,870	192,483	19,421	35,152	331,126	31,369	65,022	523,609
1927	(2)	(2)	(2)	(2)	(2)	(2)	26,099	66,452	447,068
1928	(2)	(2)	(2)	(2)	(2)	(2)	34,043	73,689	555,576
1929	12,889	27,597	139,557	25,122	46,878	406,101	38,011	74,475	545,658

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[1] 1920–1923: Missouri, Oklahoma, and Pennsylvania; 1924–1928: Missouri, Oklahoma, Pennsylvania, and Tennessee; 1929: Arkansas, Missouri, Oklahoma, Pennsylvania, and Tennessee.

[2] Bureau of Mines not at liberty to publish figures.

The companies producing tripoli (including Pennsylvania "rottenstone") in the United States in 1929, with the locations of the deposits from which the material was obtained, were as follows:

ARKANSAS

Benton County: Rogers—Corona Silica (Inc.).

ILLINOIS

Alexander County:
  Elco—
    Illinois Silica Co. (address, Cairo).
    International Silica Co. (address, Cairo).
  Olive Branch—Olive Branch Mineral Products Co. (address, Mound City).
  Tamms (near)—
    American Minerals Corporation (address, Murphysboro).
    Isco-Bautz Co. (address, Murphysboro).
    Star Silica Co. (address, Cairo).

MISSOURI

Newton County:
  Racine—Independent Gravel Co. (address, Frisco Building, Joplin).
  Seneca—American Tripoli Co.

OKLAHOMA

Ottawa County: Seneca, Mo. (near)—American Tripoli Co. (address, Seneca, Mo.).

PENNSYLVANIA

Lycoming County: Antes Fort—Penn Keystone Co. (address, 551 Fifth Avenue, New York, N. Y.).

TENNESSEE

Bradley County: Cleveland (near)—Southern Minerals Corporation (address, 192 Bank Street, Burlington, Vt.).
Wayne County: Waynesboro—C. C. Houston & J. W. Young (address, Lewisburg).

DIATOMITE

Diatomite is also known as diatomaceous earth, infusorial earth, and kieselguhr. It is a fine-grained hydrous or opaline form of silica. Deposits of diatomite consist chiefly of accumulations of the skeletal remains of minute marine organisms known as diatoms. The organic structure of the particles is plainly visible under a microscope with high magnification, affording a definite and easy means of identification. Thus, diatomite can be readily distinguished from tripoli, which shows no organic structure.

The outstanding characteristics of diatomite, upon which its usefulness depends, are its extreme fineness and uniformity of grain size, its light weight, and its high porosity. When dry it weighs only 18 to 20 pounds per cubic foot, and exceptionally even less, and it will absorb from one and a half to two times its weight of water.

The chief use of diatomite is not as an abrasive; it is used mainly as a filtering and clarifying agent, as an insulator, as a filler, and as an absorbent. As an abrasive its chief uses are for polishing metals, glass, furniture, enamel, finger nails, and teeth. Its value as a polishing agent depends not only upon the hardness, fineness, and uniformity of the grain size of the siliceous particles but upon its porous structure and low compressive strength, which permit it to crumble under pressure and thus provide an abrasive effect without scratching. It is a good cleanser not only because of its abrasive qualities but also because of its power to absorb readily grease, coloring matter, and other impurities.

In 1929, as usual, the chief source of production of diatomite was California; sales were also reported from Oregon, Washington, Nevada, New York, Florida, New Hampshire, Maryland, and Virginia.

Diatomite sold or used by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	61,922	$1,079,693	1925	73,030	$922,281
1921	[1] 55,134	[1] 682,616	1926	[1] 87,126	[1] 1,081,564
1922	44,761	386,669	1927	(2)	(2)
1923	65,833	699,406	1928	(2)	(2)
1924	63,163	693,917	1929	(2)	(2)

[1] Partly estimated.
[2] Bureau of Mines not at liberty to publish figures.

The companies producing diatomite in the United States in 1929, with the locations of the deposits from which the diatomite was obtained, were as follows:

CALIFORNIA

Fresno County: Mendota—Mineral Products Manufacturing Co. (address, 1735 Ventura Avenue, Fresno).
Los Angeles County: Torrance—Floatstone Products Co. (address, 423 Wall Street, Los Angeles).
Monterey County: Monterey (near)—The Calatom Co. (Inc.) (address, Monterey).
Santa Barbara County:
    Lompoc—
        Celite Corporation.
        National Silica Products Co. (address, 605 Market Street, San Francisco).

FLORIDA

Lake County: Clermont—Florida Diatomite Co.

MARYLAND

Calvert County: Dunkirk (near)—Diatomaceous Products Co. (Inc.) (address, 907 Fifteenth Street NW., Washington, D. C.).

NEVADA

Elco County:
    Carlin—
        Carlin Products Co. (Inc.) (address, 676 Subway Terminal Building, Los Angeles, Calif.).
        Tri-o-lite Products Co.
Esmeralda County: Basalt (near)—U. S. Diatom Co. (address, 800 Santa Fe Avenue, Los Angeles, Calif.).
Storey County: Virginia City—The Electro-Silicon Co. (address, 22 Cliff Street, New York, N. Y.).

NEW HAMPSHIRE

Grafton County: Canaan—New England Minerals (Inc.) (address, 85 Devonshire Street, Boston, Mass.).

NEW YORK

Herkimer County: Poland—Adirondack Diatomaceous Earth Co. (address, Herkimer).

OREGON

Deschutes County: Terrebonne—Atomite Corporation (address, 1021 Pacific Building, Portland).
Malheur County: Harper—Whiteurth Products Corporation.

VIRGINIA

Westmoreland County: Oak Grove—American Diatom Co. of Virginia (address, 618 Witherspoon Building, Philadelphia, Pa.).

WASHINGTON

Kittitas County:
    Kittitas—Kittitas Diatomite Co. (address, Ellensburg).
    Roza—Washington Silica & Fire Clay Co. (address, 3205 Hewitt Avenue, Everett).

PUMICE AND PUMICITE

Pumice is usually found in solid coherent masses which are generally white or light gray in color. It occurs in the vicinity of active or extinct volcanoes and consists of extremely porous glassy lava which has been forced out by the sudden expansion of gases inclosed in the molten magma. When dry the blocks are so porous that they will float on water. Lump pumice is used for polishing various metals; for rubbing down wood surfaces in the manufacture of furniture, pianos, phonographs, radios, and automobile bodies; and for cleaning and polishing stone and glass. Fine lump pumice is used as a toilet article. Ground pumice is used in cleaning, scouring, and polishing compounds, in tooth pastes and powders, and as an abrasive in rubber erasers.

Pumicite, also known as volcanic dust or volcanic ash, consists of small, sharp, angular grains of volcanic glass. It is used in making cleansing compounds, abrasive hand soaps, and metal polishes. Usually it is less uniform in grain size than diatomite and therefore finds more limited use as a fine polishing powder.

Although pumice finds most important use as an abrasive, its employment with cement in the manufacture of light-weight brick for building construction is noteworthy. This branch of the industry has been more active in Europe than in America.

Production of pumice and pumicite in the United States in 1929 was reported from Yuma County, Ariz.; from Fresno, Imperial, Inyo, and Mono Counties, Calif.; from Meade, Norton, and Sheridan Counties, Kans.; from Frontier County, Nebr.; and from Klamath County, Oreg. In California the output was largely lump pumice. In Kansas and Nebraska the pumice was dug from beds of fragmental volcanic glass or so-called ash. The total quantity sold or used by producers in 1929 was 60,873 short tons, valued at $318,579.

Pumice and pumicite sold or used by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	41, 838	$114, 433	1925	40, 380	$179, 020
1921	37, 108	158, 540	1926	53, 887	208, 504
1922	45, 262	175, 600	1927	53, 298	221, 481
1923	56, 575	214, 169	1928	57, 430	278, 516
1924	43, 651	190, 253	1929	60, 873	318, 579

The companies producing pumice and pumicite in the United States in 1929, with the locations of the deposits from which the pumice and pumicite were obtained, were as follows:

ARIZONA

Yuma County: Bouse—Yuma Products Manufacturing Co. (address, 3648 Humboldt Street, Denver, Colo.).

CALIFORNIA

Fresno County:
  Friant (near)—
    Earlonite Mining Co. (address, Box 474, Selma).
    The McKenzie Estate (address, Griffith-McKenzie Building, Fresno).

Imperial County:
  Calipatria (near)—A. W. Brand (address, 305 St. Louis Block, Pasadena).
  Niland—Flynt Silica & Spar Co. (address, 1047 Richmond Street, Los Angeles).
Inyo County:
  Shoshone—
    Chas. Brown.
    California Talc Co. (address, 837 Jackson Street, Los Angeles).
    Tonopah & Tidewater Railway (address, 1014 Central Building, Los Angeles).
Mono County: Laws (near)—California Quarries Corporation (address, 1300 Quinby Building, Los Angeles).

KANSAS

Meade County:
  Fowler—
    Cudahy Packing Co. (address, 111 West Monroe Street, Chicago, Ill.).
    The Pumicite Co. (address, Ambassador Building, St. Louis, Mo.).
Norton County: Calvert—The Davidson Pumice Co. (address, Norton).
Sheridan County: Hoxie—The Davidson Pumice Co. (address, Norton).

NEBRASKA

Frontier County: Eustis—La Rue Axtell Pumice Co. (address, Ingham).

OREGON

Klamath County: Klamath Falls (near)—W. A. T. Agard (address, 2022 Woolsey Street, Berkeley, Calif.).

PEBBLES FOR GRINDING AND FLINT LINING FOR TUBE MILLS

The commercial production of pebbles used for grinding minerals, ores, cement, and for other purposes, together with the output of quartzite blocks for use as tube-mill liners, includes, so far as known to the Bureau of Mines, only the output of beach pebbles in southern California and of cut cubes and cut liners made of quartzite in Minnesota. The figures in the following table appear to cover the entire commercial output, but doubtless there was unrecorded additional production for local or own use by other companies than those reporting.

It is claimed that the supply of southern California pebbles at Encinitas Beach in San Diego County is constantly renewed. Giant kelp plants anchor themselves to the ocean floor by entwining their roots around the pebbles. In stormy seasons, particularly during the period of the northward monsoon, the kelp plants, burdened with pebbles, are carried into the shallow water and the pebbles are later washed ashore.

Pebbles for grinding and flint lining for tube mills sold or used by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	10,924	$77,823	1925	3,831	$50,147
1921	989	14,637	1926	6,219	85,146
1922	3,159	30,798	1927	3,342	46,856
1923	4,551	51,795	1928	6,288	89,321
1924	2,532	37,429	1929	4,630	66,178

ABRASIVE DIAMONDS

Abrasive diamonds, or industrial diamonds as they are commonly called, are of two types—the black diamond, or carbonado, and bort. The black diamond is the hardest known substance, the claim being made that it is 3 per cent harder than the gem diamond. It is lacking in cleavage, is opaque, and resembles a piece of lava or coal. Black diamonds are found chiefly and almost exclusively in the State of Bahia in the interior of Brazil. The second variety, or bort, consists of cull stones from the gem-diamond industry. Most of them are obtained from South Africa. Unlike the black diamond, bort has a distinct cleavage. Although the diamond is extremely hard it is also brittle and is easily shattered if subjected to a sudden shock or blow.

The chief use of industrial diamonds is in the manufacture of drill bits for rock drilling and boring. Six to eight diamonds are set in the lower edge of a hollow cylinder of soft annealed steel. By rotation the bit cuts out a cylindrical core of rock. Black diamonds are used chiefly for this purpose. The chief use of bort is in the manufacture of tools for truing abrasive wheels and in the manufacture of cutting tools which are used for turning hard rubber, ebonite, vulcanite, fiber, metals and alloys, mica, and other materials that dull other tools quickly. Diamond tools are of special value for the production of a large number of pieces of exact and uniform sizes. Perforated diamonds are used as dies for drawing fine wire of accurate and uniform cross section. Diamond saws up to 10 feet in diameter are used widely for sawing rock such as marble or granite. The diamonds are mounted in detachable steel sockets inserted at regular intervals around the rim. Small diamonds are used extensively as glass cutters. Fragments of bort are pulverized to form diamond dust, which is used for cutting and polishing precious stones, as an abrasive in drilling diamonds to make diamond dies, and in sawing porcelain and similar hard materials.

No abrasive diamonds are produced in the United States. Import figures for the past five years, as given in the table on page 79, show a general decrease in value of bort and dust, materials which are used chiefly for grinding and polishing, but a marked increase in the value of uncut diamonds used by glaziers, engravers, and miners. Imports of such diamonds in 1928 reached more than $2,750,000, and more than $4,000,000 in 1929. Much progress has been made in the manufacture of synthetic abrasive products which are substituted for diamonds in some fields of application. The fact that diamond importations can steadily increase even when faced with the growing competition of synthetic abrasives is an indication of the rapidly increasing use of abrasive materials in industry.

MISCELLANEOUS ABRASIVE MATERIALS

River silt is used to a limited extent in cleansing powders and in the manufacture of bath bricks. Clays are used as mild abrasives in some polishes and cleaning soaps. Highly burned clays are sometimes ground to a dust and used in metal polish. Talc is used for polishing peanuts and rice. Very pure high-grade lime is used for polishing surgical instruments and cutlery. Chalk is used as a mild abrasive for polishing plated ware. Feldspar is used in some window-cleaning compounds; as it is softer than quartz it is less liable to scratch glass than compounds containing some form of free silica. Silica sand is used widely in the stone-working industries for grinding smooth surfaces on slabs of slate, marble, and other materials and in various processes of sawing rock and other hard products. The abrading action of sand when driven forcibly with compressed air is utilized in sand-blast processes of cleaning stone buildings and castings in foundries, in cutting inscriptions on monuments, and in wood carving.

IMPORTS AND EXPORTS

Value of abrasive materials imported for consumption in the United States, 1925–1929

Material	1925	1926	1927	1928	1929
Millstones and burrstones	$8, 413	$6, 266	$12, 726	$6, 354	$6, 564
Grindstones	124, 319	120, 335	134, 804	114, 874	119, 264
Hones, oilstones, and whetstones	49, 108	63, 152	67, 368	45, 303	48, 207
Emery and corundum	313, 718	616, 700	264, 613	272, 533	494, 174
Garnet	200	----------	----------	115	----------
Diatomaceous earth, tripoli, and rottenstone	6, 589	14, 544	15, 403	21, 883	23, 183
Pumice	130, 460	129, 449	124, 074	159, 430	143, 944
Diamond:					
Dust and bort	760, 476	271, 382	62, 045	31, 222	89, 363
Glaziers' and engravers', unset, and miners'	1, 976, 640	1, 939, 735	2, 148, 275	2, 756, 895	4, 067, 674
Flint, flints, and flint stones, unground	105, 041	120, 078	93, 658	144, 313	127, 457

Abrasive materials imported for consumption in the United States, 1928 and 1929, by kinds

Kind	1928		1929	
	Quantity	Value	Quantity	Value
Millstones and burrstones:				
Rough or unmanufactured short tons	104	$6, 270	97	$6, 564
Bound up into millstones do	2	84	----------	----------
Grindstones, finished or unfinished do	1, 773	114, 874	1, 882	119, 264
Hones, oilstones, and whetstones do	196	45, 303	305	48, 207
Emery:				
Ore do	5, 428	84, 288	6, 403	100, 844
Grains, ground, pulverized, or refined pounds	(1)	(1)	(1)	(1)
Paper and cloth of emery or corundum do	(2)	41, 817	(2)	43, 440
Wheels, files, and other manufactures of which emery or corundum is the material of chief value pounds	100, 962	51, 148	292, 982	99, 830
Corundum (see also "Emery"):				
Ore short tons	1, 568	82, 867	3, 783	200, 739
Grains, ground, pulverized, or refined pounds	[1] 339, 236	[1] 12, 413	[1] 871, 549	[1] 49, 321
Garnet short tons	2	115	----------	----------
Diatomaceous earth, tripoli, and rottenstone do	2, 607	21, 883	3, 260	23, 183
Pumice:				
Crude or unmanufactured do	11, 099	113, 453	9, 669	95, 774
Manufactures of, or of which pumice is the component material of chief value short tons	(3)	45, 977	(3)	48, 170
Diamond:				
Bort carats	996	17, 949	4, 567	73, 200
Dust pounds	(3)	13, 273	(3)	16, 163
Glaziers' and engravers', unset, and miners' carats	38, 342	2, 756, 895	46, 949	4, 067, 674
Flint, flints, and flint stones, unground short tons	15, 719	144, 313	14, 097	127, 457
	----------	3, 552, 922	----------	5, 119, 830

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[1] Emery included with corundum; not separately classified.
[2] 7,152 reams in 1928 and 10,273 reams in 1929; weight not recorded.
[3] Quantity not recorded.

Value of domestic abrasive materials exported from the United States, 1925–1929

Material	1925	1926	1927	1928	1929
Grindstones	$553, 750	$629, 748	$578, 113	$560, 975	$391, 239
Abrasive wheels, emery and other	439, 904	248, 631	240, 027	254, 493	286, 360
All other natural abrasives, hones, whetstones, etc	195, 915	323, 447	419, 088	453, 055	423, 363

ARTIFICIAL ABRASIVES

Artificial abrasives fall chiefly into three main groups—(1) metallic abrasives such as crushed steel, steel shot, and steel wool; (2) silicon carbide abrasives such as carborundum, crystolon, and carbolon; (3) aluminum oxide abrasives such as alundum, aloxite, exolon, and lionite. The metallic abrasives are used chiefly in loose form as cutting agents in sawing or drilling rock and other hard materials. A very important use of the silicon carbide and the aluminum oxide abrasives is in the manufacture of bonded abrasive wheels. The abrasive grains graded into uniform sizes are bonded together into wheels of varying degrees of coarseness and hardness. A fusible clay is used as the bonding material in vitrified grinding wheels. Sodium silicate, shellac, rubber, and bakelite are also employed as bonding materials. Much progress has been made in recent years in the development of highly efficient abrasive wheels; they are being used more and more as substitutes for natural abrasive products such as emery wheels, grindstones, and pulpstones.

An artificial abrasive consisting of tin oxide or a mixture of tin oxide and oxalic acid has been termed "putty powder." It is used for polishing marble and granite. Rouge and crocus, both of which are forms of ferric oxide, are employed to produce a high luster—the former on precious metals and the latter on tin and cutlery. Chromium oxide, manganese dioxide, and magnesia have limited use as abrasives.

The table that follows gives the production of silicon carbide, aluminum oxide, and steel shot or crushed steel grains. These materials compete with the natural abrasives used as grains—for example, emery, corundum, and garnet. The figures represent the total output of crude materials or first product of the manufacturing plants, not all of which is used as abrasive material; in fact, a large but undetermined part of the silicon carbide and aluminum oxide output is not so used. The total output is shown here without separation of the products according to the uses to which they are put, because it is thought that the proportion used as abrasive material has not fluctuated so widely in recent years as to destroy the value of these figures for comparison with the statistics of natural abrasives.

Crude artificial abrasives sold, shipped, or used, from manufacturing plants in the United States and Canada, 1920–1929

Year	Silicon carbide		Aluminum oxide		Metallic abrasives		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	6, 887	$1, 309, 605	32, 891	$5, 956, 639	2, 659	$225, 920	42, 437	$7, 492, 164
1921	2, 707	475, 336	7, 325	1, 318, 771	3, 167	202, 040	13, 199	1, 996, 147
1922	16, 233	2, 022, 613	31, 898	3, 246, 714	5, 804	421, 148	53, 935	5, 690, 475
1923	21, 149	2, 786, 929	51, 391	5, 378, 926	8, 229	612, 140	80, 769	8, 777, 995
1924	17, 792	2, 161, 498	33, 708	3, 482, 577	8, 597	569, 665	60, 097	6, 213, 740
1925	24, 112	2, 493, 756	53, 253	4, 714, 562	11, 165	780, 612	88, 530	7, 988, 930
1926	17, 026	1, 702, 037	43, 967	4, 106, 699	12, 610	942, 429	73, 603	6, 751, 165
1927	26, 289	2, 603, 571	50, 973	4, 516, 637	13, 364	839, 683	90, 626	7, 959, 891
1928	22, 162	2, 286, 518	59, 103	5, 640, 901	18, 466	904, 629	99, 731	8, 832, 048
1929	30, 309	3, 060, 401	72, 614	6, 471, 373	23, 789	1, 289, 922	126, 712	10, 821, 696

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FELDSPAR[1]

By OLIVER BOWLES and JEFFERSON MIDDLETON

GENERAL CONDITIONS

As indicated by detailed figures given in this report, the feldspar industry declined both in volume of production and in value during 1929, as compared with 1928. The average value per ton of both crude and ground spar also decreased markedly. Although consumption declined, production capacity continued to increase—two more grinding mills operating in 1929 than in 1928. The estimated capacity of feldspar grinding mills in the United States is now considerably more than twice as great as the average annual consumption of ground feldspar.

OCCURRENCE

The feldspars form a considerable part of such common and widespread igneous rocks as granites, in which they occur in grains ranging in size from that of a pinhead to one-half inch or more across. Such small crystals associated with other minerals can not be regarded as profitable sources of supply even though in total quantity they constitute a vast amount of material. The feldspars of commerce are obtained from pegmatite dikes, irregular lenslike or elongated masses consisting chiefly of large masses of feldspar and quartz associated with small quantities of other characteristic minerals such as muscovite, biotite, tourmaline, garnet, and beryl.

The principal deposits of feldspar in the United States are along the Atlantic seaboard from Maine to North Carolina. These eastern localities produce about 90 per cent of the total. Supplies of crude spar are also obtained from California, Arizona, Colorado, and South Dakota.

VARIETIES

The feldspars most widely used are orthoclase and microcline, each having the composition $KAlSi_3O_8$ and differing only in their form of crystallization. They are known as the potash feldspars. Albite ($NaAlSi_3O_8$) or soda feldspar, anorthite ($CaAl_2Si_2O_8$) or lime feldspar, or mixtures of these are used to some extent.

USES

Feldspar is used chiefly as a flux in the manufacture of glass, pottery, enamel ware, brick, and tile. It is a constituent of both body and glaze, constituting 10 to 35 per cent of the body and 30 to 50 per cent of the glaze. Various forms of opaque glass that find use in hotels, restaurants, drug stores, and other places where a vitrified surface is desired for sanitary reasons contain considerable quantities of feldspar. Bath tubs and wash bowls are commonly made of cast iron and, while hot, covered with an enamel containing much feldspar. Feldspar is also an important constituent of electrical and other forms of porcelain. Exceptionally pure potash feldspar is used in the manufacture of artificial teeth.

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[1] Work on manuscript completed July, 1930.

The use of feldspar in the glass industry is increasing, because its composition approaches that of some types of glass. It improves the toughness and luster of bottle and pressed-glass products, and it prolongs the working temperature during the manufacturing process. As yet feldspar has found limited use in the window and plate glass industries, and its more general application in this field would greatly increase the market for feldspar.

Very clean feldspar is used as a constituent of scouring soaps and window-cleaning compounds. It is preferred to quartz abrasives for cleaning glass and enamel ware, because it is somewhat softer than quartz and is less likely to scratch the surface. Feldspar is used as a binder in the manufacture of emery and corundum wheels. The more impure grades of feldspar find use in the form of granules for surfacing prepared roofing, in concrete work, in stucco and pebble dash, and in the facing of cement blocks, particularly those designed to resemble granite. It is used as sand-blast material and as a poultry grit. Graded in several sizes it is sold for foundry facings. Pulverized impure feldspar finds limited use in the manufacture of certain floor coverings, as a constituent of roofing material, sandpaper, paint, wood filler, and terra cotta, and as a flue-dust arrester. It has been used to a limited extent as a source of potash.

The following statement indicates the approximate percentage of feldspar consumed in the United States for the various uses:

Approximate consumption of feldspar in various industries

	Per cent
Ceramic and glass industries	87
Scouring soaps and abrasives	7
Binder for abrasive wheels	2
Poultry grit, roofing, stucco, and other minor uses	4

SPECIFICATIONS AND TESTS

The feldspar used in the pottery and glass industries should burn to a uniform white color and be free from specks and spots. Therefore the iron-bearing minerals, such as biotite, garnet, hornblende, and black tourmaline, are the most detrimental. The quartz content of commercial spar is quite variable. For the finer grades of pottery it is limited to about 5 per cent, whereas for ordinary grades the quartz content may run as high as 15 or 20 per cent. A high alumina content is preferred for glassmaking. Manufacturers of clay wares demand a product pulverized exceptionally fine, usually so fine that not more than 1 per cent will remain on a 200-mesh sieve. The glass and metal-enameling industries use coarser material. The ordinary requirement is 20-mesh for glass and 100-mesh for enamel, but occasionally orders are received for 40, 60, 80, and 140 mesh for both of these applications.

As feldspar is usually bought and sold on rather loose and indefinite specifications, resulting in misunderstanding and confusion, a committee was appointed by the division of trade standards of the Bureau of Standards at the request of the Feldspar Grinders' Institute (Inc.) to recommend a standard for feldspar acceptable to producers, grinders, and users. The difficulty in arriving at exact specifications is due in large measure to lack of a definite classification of feldspars. As a step toward the establishment of better specifications a tentative classification was established through two conferences of producers, distributors, users, and technical advisers. The classification relates to feldspar suitable for use in ceramic bodies, glazes, and for glass-making. The scheme of classification was submitted for trial; as a satisfactory majority of acceptances had been received, September 1, 1930, was set as the date on which the standard would be effective for new production.

MARKETING

Feldspar is used chiefly in glass making and ceramics; hence, the demand fluctuates with increasing activity or depression in these industries. In the United States during the last few years about 175,000 tons of feldspar annually has been mined and ground for this trade alone.

The market for pulverized feldspar is confined largely to well-defined areas, including New York, New Jersey, West Virginia, Ohio, and Indiana; Trenton, N. J., and the vicinity of East Liverpool and Sebring, Ohio, are the principal centers.

Feldspar is generally sold in carload lots. Several large companies both mine and grind their spar, selling the ground product to potters and other users. Hundreds of smaller producers sell their output of crude spar to the various mills. Some companies market their output through a single broker or selling agency. Amounts less than carload lots usually are handled by brokers and supply houses. The consumption of ground feldspar is practically uniform throughout the year, although the demand may fluctuate at times.

Feldspar is shipped in bulk or in bags. For bulk shipments the car is usually lined with paper, although the pulverized spar may be dumped directly on the car floor. Many shipments are made in burlap bags. The Feldspar Grinders' Institute (Inc.) has announced recently the use of waterproof paper bags designed to hold 100 pounds. The bags are to be billed to the customer at cost and are not returnable. The shipment of feldspar in bags means less loss of spar, less contamination in transportation, and easier handling.

PRODUCTION

CRUDE FELDSPAR

"Crude feldspar" is a term applied to the lump spar shipped from the mine or quarry, as contrasted with ground spar which is the finished product of the crushing and pulverizing mill. Statistics of production are presented separately for crude and ground spar. In accordance with the practice common in the industry, the crude is reported in long tons of 2,240 pounds and the ground in short tons of 2,000 pounds.

The crude feldspar sold or used by producers in the United States in 1929 amounted to 197,699 long tons, valued at $1,276,640, a decrease of 6 per cent in quantity and 10 per cent in value, compared with 1928. The average value of crude feldspar in 1929 at the mine or shipping point nearest thereto was $6.46 a long ton, or 27 cents lower than that in 1928 and 58 cents lower than that in 1927. The average value of ground domestic feldspar was $13.73 a short ton, or 82 cents lower than that in 1928 and $1.40 lower than that in 1927. The average value for crude feldspar as reported by individual producers ranged from $3 in Pennsylvania to $12.32 in New Hampshire. For New England the range was from $3.50 to $12.32; for Maryland, New York, Pennsylvania, and Virginia, from $3 to $9.15; for North Carolina, from $4.79 to $6.74; and for Arizona, California, Colorado, and South Dakota, from $3.09 to $11.19.

Crude feldspar was reported from the same States in 1929 and 1928. North Carolina continued to be the leading producing State and in 1929 reported 52 per cent of the total quantity; New Hampshire was second with 16 per cent of the total; and Maine was third with 10 per cent of the total. New Hampshire was the only one of these three States to show an increase in the sales of crude feldspar in 1929.

Crude feldspar sold or used by producers in the United States, 1920–1929

Year	Long tons	Value		Year	Long tons	Value	
		Total	Average			Total	Average
1920	135, 551	$851, 123	$6. 28	1925	185, 706	$1, 315, 654	$7. 08
1921	91, 865	617, 652	6. 72	1926	209, 989	1, 607, 101	7. 65
1922	117, 127	844, 568	7. 21	1927	202, 497	1, 424, 755	7. 04
1923	145, 004	1, 057, 595	7. 29	1928	210, 811	1, 418, 975	6. 73
1924	204, 772	1, 509, 339	7. 37	1929	197, 699	1, 276, 640	6. 46

Crude feldspar sold or used by producers in the United States, 1924–1929, by States

[Value is at mine or nearest shipping point]

State	1924		1925		1926	
	Long tons	Value	Long tons	Value	Long tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	8, 027	$62, 344	6, 077	$49, 881	6, 271	$49, 300
Colorado	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut	6, 572	51, 422	10, 426	71, 201	11, 436	87, 844
Maine	29, 912	271, 354	28, 404	256, 731	33, 897	306, 695
Maryland	4, 854	25, 020	4, 554	26, 438	(1)	(1)
New Hampshire	39, 425	324, 638	38, 366	278, 736	33, 271	287, 596
New York	13, 839	108, 751	10, 474	70, 446	15, 517	157, 865
North Carolina	97, 075	640, 403	76, 806	496, 563	91, 433	602, 020
Pennsylvania	1, 481	4, 763	1, 330	4, 722	1, 484	4, 492
South Dakota	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed	3, 587	20, 644	9, 269	60, 936	16, 680	111, 289
	204, 772	1, 509, 339	185, 706	1, 315, 654	209, 989	1, 607, 101

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[1] Included under "Undistributed."

Crude feldspar sold or used by producers in the United States, 1924–1929, by States—Continued

State	1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	5,260	$43,329	11,891	$81,199	12,770	$84,567
Colorado	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut	6,123	43,319	6,292	48,996	2,726	21,056
Maine	34,328	299,386	25,063	202,219	19,992	142,042
Maryland	2,001	11,612	2,349	10,325	2,624	19,610
New Hampshire	27,449	223,077	30,343	236,224	30,964	231,810
New York	12,020	96,446	13,971	120,559	12,696	103,531
North Carolina	100,756	612,214	105,560	630,042	103,273	598,938
Pennsylvania	3,938	24,257	2,052	8,851	(1)	(1)
South Dakota	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	(1)	(1)	(1)	(1)	6,677	38,628
Undistributed	10,622	71,115	13,290	80,560	5,977	36,458
	202,497	1,424,755	210,811	1,418,975	197,699	1,276,640

[1] Included under "Undistributed."

GROUND FELDSPAR

Probably all the feldspar consumed industrially, except that used for facing cement blocks, for covering prepared roofing, for "chicken grits," and for like purposes, is prepared by fine grinding. Even for such uses the spar is at least crushed to small sizes and more or less graded by screening, but it has not been possible to canvass all users of feldspar to determine the amounts ground and used by them. All known merchant mills or grinders—that is, those who quarry or purchase crude spar and grind it for sale to other establishments—have been canvassed during the last eight years for statistics of ground feldspar.

In 1929, 31 operators running 33 mills in 13 States reported 230,582 short tons of ground feldspar sold, an increase of 2 operators, 2 mills, and 1 State compared with 1928, South Dakota entering the list of feldspar grinders in 1929. Of the mills reporting, 29 worked exclusively on domestic spar and 4 exclusively on imported spar. No mill was reported as having worked on both domestic and imported spar in 1929. Of the total quantity, 209,808 short tons, or 91 per cent, was from domestic spar and 20,774 tons, or 9 per cent, from imported spar, a gain in favor of domestic spar.

In 1929 the average value per ton of ground feldspar from domestic crude was $13.73, the lowest recorded in recent years and a decrease of 82 cents compared with 1928 and of $3.11 compared with 1924, the year of highest recorded average; the average value in 1929 ranged from $9.42 to $24.01 per ton. The average value of ground feldspar from imported crude in 1929 was $20, a decrease of 46 cents compared with 1928 and of $1.13 compared with 1927, the year of highest recorded value. These figures show that whereas the average value of ground spar from domestic crude has declined considerably—18 per cent from the high value of 1924—that from imported spar has declined but slightly—5 per cent from its highest average value. Direct comparisons of values are, however, misleading, as figures for Canadian spar generally relate to high-grade material at mills near points of consumption, whereas figures for domestic spar cover all grades at various points, many of which are distant from consuming centers.

The feldspar-grinding center is now and has been for several years in the region comprising western North Carolina and the adjacent territory in Tennessee. This is the natural center of the industry by reason of the large production of crude feldspar in western North Carolina. This region reported 50 per cent of the total ground spar from domestic crude sold in 1929, compared with 46 per cent in 1928 and 41 per cent in 1927. North Carolina is the leading State in the sales of ground spar, with Tennessee second, New Jersey third, and Maine fourth.

The spar-grinding industry has developed in eastern Tennessee by reason of its proximity to the producing mines in North Carolina and its transportation facilities. In 1927 and 1928 two of the Tennessee mills were removed to North Carolina and two new mills erected in North Carolina; this region now has seven mills, most of which are modern plants.

Ground feldspar sold by merchant mills[1] in the United States, 1922–1929

Year	Number of operators	Domestic			Canadian [2]			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
1922	20	107,969	$1,790,305	$16.58	19,075	$364,082	$19.09	127,044	$2,154,387
1923	26	151,855	2,486,810	16.38	25,374	486,546	19.17	177,229	2,973,356
1924	30	163,905	2,760,286	16.84	25,875	522,884	20.21	189,780	3,283,170
1925	33	184,816	3,017,845	16.33	28,042	586,000	20.90	212,858	3,603,845
1926	29	199,215	3,246,174	16.29	26,147	529,623	20.26	225,362	3,775,797
1927	30	194,672	2,946,154	15.13	[2] 29,243	[2] 617,987	21.13	223,915	3,564,141
1928	29	202,844	2,951,281	14.55	[2] 24,813	[2] 507,747	20.46	227,657	3,459,028
1929	31	209,808	2,880,824	13.73	20,774	415,428	20.00	230,582	3,296,252

[1] Does not include potters or others who grind for consumption in their own plants.
[2] Figures for 1927 and 1928 include some Cornwall stone.

Ground feldspar sold by merchant mills[1] in the United States, 1928 and 1929, by States

State	1928					1929				
	Number of operators	Domestic		Canadian [2]		Number of operators	Domestic		Canadian	
		Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
California	3	13,778	$180,853			3	11,917	$152,574		
Connecticut	3	2,525	36,764			1	(3)	(3)		
Maine	4	26,776	488,246			4	21,296	365,017		
New Jersey	4	24,085	459,507	(3)	(3)	4	22,764	434,095		
New York	4	(3)	(3)	20,852	$421,356	5	(3)	(3)	(3)	(3)
Ohio	3	(3)	(3)	(3)	(3)	2	(3)	(3)	(3)	(3)
North Carolina	3	93,636	1,130,349			5	105,626	1,236,206		
Tennessee	1					1				
Undistributed [4]	4	42,044	655,562	3,961	86,391	6	48,205	692,932	20,774	$415,428
	29	202,844	2,951,281	24,813	507,747	31	209,808	2,880,824	20,774	415,428

[1] Does not include potters or others who grind for consumption in their own plants.
[2] Figures include some Cornwall stone ground in New Jersey in 1928.
[3] Included under "Undistributed."
[4] 1928: Colorado, Illinois, Maryland, New Hampshire, New Jersey (imported), New York (domestic), and Ohio. 1929: Connecticut, Illinois, Maryland, New Hampshire, New York, Ohio, South Dakota and Virginia.

INDUSTRY BY STATES

General data.—The production (or sales) of crude feldspar was reported from the same 12 States in both 1929 and 1928. In the order of quantity in 1929 the States are: North Carolina, New Hampshire, Maine, California, New York, Virginia, South Dakota, Connecticut, Maryland, Arizona, Colorado, and Pennsylvania. Six of these States maintained their respective ranks in both years, namely, North Carolina (first), New Hampshire (second), Maine (third), South Dakota (seventh), Maryland (ninth), and Arizona (tenth). Connecticut fell from sixth to eighth, and Virginia rose from eighth to sixth. The other States varied only slightly. The first five States, as listed above, reported 91 per cent of the total sales of crude feldspar in 1929. The principal producing region is along the Atlantic seaboard from Maine to North Carolina, and this region reported 91 per cent of the total output in 1929. Feldspar was ground in commercial mills in 1929 in each of the producing States except Arizona, Colorado, and Pennsylvania; in addition, mills grinding feldspar were operated in Illinois, New Jersey, Ohio, and Tennessee.

Arizona.—Deposits of feldspar in Arizona were operated in 1929 by the Gold Cliff Central Mining Co. and the Crescent Feldspar Co., both at Kingman. The State ranked tenth in both quantity and value of crude feldspar. The spar from Arizona is shipped to California for use.

California.—In 1929 California was one of the three States that showed an increase in both quantity and value of crude feldspar sold; the State rose in quantity from fifth place to fourth. The increase in quantity was 7 per cent and in value 4 per cent, compared with 1928. The quantity of ground spar marketed in California in 1929 decreased 14 per cent and its value decreased 16 per cent, compared with 1928; the State ranked sixth in both quantity and value. Mills were operated in 1929 by the American Encaustic Tiling Co. (Ltd.) and the Flynt Silica & Spar Co., of Los Angeles and the Standard Sanitary Manufacturing Co., of Richmond.

Colorado.—In 1929 the quantity and value of crude feldspar in Colorado decreased considerably, compared with 1928, and the State ranked eleventh in both quantity and value. No ground spar was reported for 1929.

Connecticut.—In 1929 Connecticut ranked eighth in quantity and value of crude spar and twelfth in quantity and value of ground spar. The quantity and value of both crude and ground spar decreased, compared with 1928. Seven operators reported sales of crude spar, and one, the River Feldspar Co., of Middletown, which produced its own spar, reported sales of ground spar in 1929. This company has retired from business.

Illinois.—Two mills were operated in Illinois in 1929, one at Abingdon, by the Abingdon Sanitary Manufacturing Co., and the other at Murphysboro, by the Consolidated Feldspar Corporation. The latter mill was moved during the year to South Dakota. Both mills obtained crude spar from South Dakota.

Maine.—In 1929 Maine ranked third among the States in quantity and value of crude spar and fourth in quantity and value of ground spar. In 1928 it ranked third in quantity and value of both crude and ground domestic spar. The quantity and value of both crude and ground spar were less than in 1928; crude spar decreased 20 per cent in quantity and 30 per cent in value, and ground spar decreased 20 per cent in quantity and 25 per cent in value. Maine reported 10 per cent of the total quantity of crude spar and 11 per cent of its value and furnished 10 per cent of the domestic ground spar marketed and 13 per cent of its value. Androscoggin, Cumberland, Oxford, and Sagadahoc were the producing counties. Most of the spar mined in Maine is ground in mills in the State. These mills were operated by the Consolidated Feldspar Corporation, of Trenton, N. J., with mills at Auburn and Topsham; the J. W. Cummings Feldspar Co., at Bath; the Trenton Flint & Spar Co., of Trenton, N. J., with mill at Cathance; and the Oxford Mining & Milling Co., of New York, N. Y., with mill at Bates.

Maryland.—In 1929 the output of crude feldspar in Maryland increased 12 per cent in quantity and 90 per cent in value, compared with 1928. Maryland was ninth in quantity and value of crude spar and tenth in quantity and value of ground spar. The only grinder in the State, the Seaboard Feldspar Co., Baltimore, obtained its crude spar from the quarries of the State and from Virginia.

New Hampshire.—In 1929 New Hampshire ranked second in quantity and value of crude spar and fifth in quantity and value of ground spar. The State reported 16 per cent of the total output of crude spar and 18 per cent of its value. The quantity of crude spar increased 2 per cent and its value decreased 2 per cent, compared with 1928. The Golding-Keene Co., Keene, operated the only mill in the State. The American Mineral Products Co. (Inc.), of Hartford, Conn., was constructing a mill at Cold River in 1929.

New Jersey.—New Jersey produces no crude feldspar, yet it is an important State in the industry, being a large producer of ground feldspar as well as a large consumer of that material in its pottery industry. At Trenton are the mills of the Eureka Flint & Spar Co., the Golding Sons Co., the Standard Flint & Spar Corporation, and the Trenton Flint & Spar Co. In 1929 the State ranked third in quantity and second in value of domestic ground spar; the mills reported 22,764 short tons of ground spar sold, valued at $434,095, 11 per cent of the total quantity and 15 per cent of the total value, but a decrease of 5 per cent in quantity and 6 per cent in value, compared with 1928.

New York.—In 1929 New York ranked fifth in quantity and fourth in value of crude spar and seventh in quantity and eighth in value of domestic ground spar. It is the largest grinder of Canadian spar, and ranked third in 1929 in the total production of ground spar. Its output of crude spar came from Essex, Fulton, and Westchester Counties. The quantity and value of the crude spar sold or used by the miner decreased 9 and 14 per cent, respectively, compared with 1928. There were five active mills in the State, an increase of one compared with 1928. They were as follows: The United States Feldspar Corporation, at Cranberry Creek; the Consolidated Feldspar Corporation (Trenton, N. J.), with 3 mills, 1 at Bedford and 2 at Rochester; and the Genesee Feldspar Co. (Inc.), at Rochester. Early in 1929 the Consolidated Feldspar Corporation acquired the mill of the Bedford Mining Co. (Inc.), Bedford, and those of the Dominion Feldspar Corporation and the New York Feldspar Corporation, both at Rochester. Two mills were under construction in

1929, one at De Kalb, by the Green Hill Mining Co. (Inc.), and one at Crown Point, by the Crown Point Chemical Co. (Inc.).

North Carolina.—In 1929, as for many years, North Carolina was the largest producer of crude feldspar; it was also, for the second time, the largest producer of ground spar. The output of crude feldspar in North Carolina in 1929 was 52 per cent of the total for the United States and was more than three times that of New Hampshire, the second State. Sales of crude feldspar decreased 2 per cent in quantity and 5 per cent in value, compared with 1928. The quantity marketed in 1929 was the largest recorded except that in 1928, but the value of the output in 1929 was exceeded by that in four other years, namely, 1924 (the record year), 1926, 1927, and 1928. The average value per ton of crude spar in 1929 was $5.80, compared with $5.97 in 1928 and $6.08 in 1927. A considerable part of the output was made by numerous small producers who sell their feldspar to some large user or central distributing agency. Some of the larger buyers in 1929 were the Carolina Mineral Co. (Inc.) and the Tennessee Mineral Products Corporation, both of Spruce Pine; the Feldspar Milling Co. (Inc.), Tryon; and the North State Feldspar Corporation, Micaville. In 1929 most of the spar (about 80 per cent of the State total) was produced in Mitchell County. Feldspar was produced also in Avery and Yancey Counties. Five grinding mills were operated in North Carolina in 1929 (an increase of 2 over 1928)—1 by the Feldspar Milling Co. (Inc.), at Bowditch; 1 by the North State Feldspar Corporation, at Micaville; 2 at Spruce Pine—1 by the Golding Sons Co. and the other by the Tennessee Mineral Products Corporation; and 1 by the Southern Feldspar (Inc.), at Toecane. The mills in North Carolina and Tennessee reported 105,626 short tons of domestic ground feldspar, or 50 per cent of the total sold in 1929; it was valued at $1,236,206, or 43 per cent of the total value.

Ohio.—No feldspar is produced in Ohio, but this State and the adjacent territory in Pennsylvania and West Virginia produce more than one-half of the high-grade pottery made in the United States; hence the region is a large consumer of feldspar. The potteries are partly supplied by the mills in Ohio, which are operated by the Golding Sons Co., at East Liverpool, and the Rock Products Co., at Silica, near Toledo. The Golding Sons Co. ground only domestic spar and the Rock Products Co. ground only Canadian spar.

Pennsylvania.—Pennsylvania ranked twelfth in both quantity and value of crude feldspar sold in 1929.

South Dakota.—The output of crude feldspar in South Dakota decreased considerably in 1929 compared with 1928. The mill at Murphysboro, Ill., formerly operated by the Isco-Bautz Co. (Inc.), was purchased by the Consolidated Feldspar Corporation and moved during the year to Keystone, thus adding South Dakota to the list of feldspar grinders.

Tennessee.—Tennessee is another State that has no feldspar mines but is a large producer of ground feldspar; it ranked second in 1929 in quantity of ground feldspar sold. There are two mills in the State, both at Erwin and both operated by the Erwin Feldspar Co. (Inc.).

Virginia.—The Seaboard Feldspar Co., of Baltimore, Md., controls several quarries in Virginia. Two other companies—the Virginia Feldspar Co., Bedford, and the Mica Products Corporation, Norfolk, with quarry at Axton—reported crude spar. The General Minerals

Corporation of Virginia operated during 1929, but marketed gem feldspar only. The Seaboard Feldspar Co. began operating a grinding mill at Brookneal, thus adding Virginia to the list of feldspar-grinding States.

IMPORTS[2]

The foreign trade of the United States in feldspar is small and is limited largely to imports from Canada. Before the tariff of 1922 (September 22) imports of feldspar were not specifically classified in the official records of the Bureau of Foreign and Domestic Commerce and are therefore unknown, but from that date to the end of the year 37 long tons of crushed or ground feldspar, valued at $538, was imported. No imports of crushed or ground feldspar were recorded from 1923 to 1925, but 36 long tons, valued at $1,743, was imported in 1926; 250 pounds, valued at $3, in 1927; 49 long tons, valued at $1,091, in 1928; and 3 long tons, valued at $131, in 1929. The following table shows the imports of crude feldspar from 1922 to 1929.

Crude feldspar imported for consumption in the United States, 1922–1929

Year	Long tons	Value	Year	Long tons	Value
1922 (Sept. 22–Dec. 31)	7,549	$60,111	1926	29,941	$251,896
1923	24,271	184,924	1927	27,424	206,856
1924	35,139	284,716	1928	27,857	224,920
1925	24,994	203,524	1929	29,927	241,852

WORLD PRODUCTION

The following table shows the most recent figures of production of feldspar in the chief producing countries. Besides the United States and Canada, the important producing countries are Norway, Russia, and Sweden. Although Great Britain has an immense pottery industry, it appears to have produced no feldspar in recent years. Cornwall stone rather than feldspar is extensively used as a flux in the British pottery industry.

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[2] Figures on imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

World production of feldspar, 1925–1929, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
Argentina (shipments)	----------	----------	185	410	(2)
Australia:					
New South Wales	33	11	[3] 16	[3] 49	[3] 58
South Australia [3]	10	105	93	115	(2)
Western Australia (exports)	----------	8	----------	----------	21
Canada (shipments)	26,019	32,614	27,078	28,936	34,044
Finland (exports)	753	738	553	720	(2)
France	3,200	10,550	(2)	(2)	(2)
Germany (Bavaria)	10,258	6,660	7,320	6,230	7,697
Italy	3,400	5,878	4,054	4,960	(2)
Japan	19,049	(2)	(2)	(2)	(2)
Norway (exports)	26,785	20,510	27,650	24,075	26,524
Rumania	423	1,700	1,943	2,835	(2)
Russia [4]	8,613	18,640	19,324	(2)	(2)
Sweden	26,751	33,970	30,636	39,921	(2)
Union of South Africa	----------	101	29	30	----------
United States (shipments)	188,687	213,359	205,747	214,195	200,872

[1] In addition to the countries listed, feldspar is produced in Czechoslovakia. Official figures of output are not available, but it is estimated that the annual production is approximately 30,000 metric tons.

[2] Data not available.

[3] Includes some china stone.

[4] Data for year ended Sept. 30.

Canada.—A considerable quantity of crude feldspar, ranging from 24,000 to 30,000 long tons, has been imported from Canada annually during recent years. According to reports of the Dominion Bureau of Statistics the Canadian shipments—all from Ontario and Quebec—increased 18 per cent in quantity and 19 per cent in value in 1929 as compared with 1928. The amount shipped to the United States represents about 90 per cent of the total Canadian production. Canadian spar has a restricted market that is limited largely by freight rates. The market also is highly competitive and the lump spar must be delivered at grinding mills within certain price limits. With a given cost of production plus a percentage of profit, the distance that the feldspar can be profitably hauled by railroad is rather definitely fixed, and the freight charge is therefore the main factor governing Canadian production. Conditions in the United States have narrowed the market for the Canadian product to the most northerly mills, those at Rochester, N. Y., and at Toledo, Ohio. Canadian feldspar is mined at Buckingham, Quebec, and at Hybla, Perth, and Verona, Ontario.

The production of feldspar in Canada over a period of years is shown in the following table.

Feldspar, produced in Canada, sold in 1920–1929

Year	Long tons	Value	Year	Long tons	Value
1920	33,815	$280,895	1925	25,608	$235,789
1921	26,668	230,754	1926	32,099	310,238
1922	24,756	248,402	1927	26,651	259,151
1923	26,094	237,601	1928	28,479	284,942
1924	40,004	358,540	1929	33,506	340,471

CLAY[1]

By JEFFERSON MIDDLETON

GENERAL CONDITIONS

Clay available for the manufacture of clay products, the largest use, is widely distributed throughout the United States, and there are clay-working plants in every State. The tables of production that follow represent chiefly the clay that was mined and sold as clay, or mined under royalty or shipped into another State for fabrication, and do not include the clay that was burned into clay products by the producers themselves, unless it was mined under royalty or in a different State from that in which it was used. The quantity of clay thus sold is small compared with the total output and mainly includes clay used for making high-grade pottery and tile, paper, and refractory products. The values given for domestic production are f. o. b. mines or works; for imports, at the principal markets of the countries from which the clay was exported; for exports, at the port of shipment.

The domestic clay-mining industry in 1929 again had an active year, and the total sales of clay were the highest ever recorded, in both quantity and value. Three of the kinds of clay, as classified in this report, increased in quantity and four increased in value as compared with 1928. Total sales in 1929 amounted to 4,347,020 short tons, valued at $14,850,744, an increase of 8 per cent in quantity and 5 per cent in value as compared with 1928 and an increase of 91 per cent in quantity and 109 per cent in value as compared with 1919. Kaolin and fire clay were the only kinds to reach maximum quantity in 1929, and kaolin and ball clay were the only kinds to reach maximum value.

The increasing sales of domestic clays for use in the higher grades of ceramic ware and paper and for other products, the demand for which has been largely supplied by foreign material, together with the decreasing imports of such clays, indicate the growing use of domestic clays in these industries and lead to the hope that domestic manufacturers of these commodities may become independent of foreign clays. In 1929 domestic mines supplied 65 per cent of the new supply of kaolin in the United States.

The estimated sales of bentonite in 1929 amounted to 69,658 tons, valued at $620,879, an increase of 5 per cent in quantity but a decrease of 9 per cent in value as compared with 1928.

The sales of domestic kaolin, the chief clay used in the manufacture of high-grade ceramic wares, paper, etc., increased 4 per cent in quantity in 1929 over 1928, whereas the imports of kaolin, or china clay, decreased 9 per cent. The sales of kaolin in 1929 were more than three times those in 1919. The Southern States are the chief source of supply of domestic kaolin; they reported 86 per cent of the total in 1929, and Georgia, the largest producer, reported 53 per cent of the total.

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[1] Work on manuscript completed August, 1930.

Ball clay, which is used principally with kaolin in the bodies of high-grade ceramic wares, decreased 2 per cent in quantity but increased slightly—0.3 per cent—in value as compared with 1928.

Slip clay, a low-fusing material that formerly was used chiefly as a stoneware glaze, now finds its chief use as a binder in the manufacture of abrasives. In 1929 the sales of slip clay increased 12 per cent in quantity and 25 per cent in value as compared with 1928. The sources of supply of slip clay in 1929, as in several years past, were Michigan and New York.

Stoneware clay, the principal use of which is indicated by its name, decreased 9 per cent in quantity and 12 per cent in value as compared with 1928. The term "stoneware clay" is used rather loosely; much, if not all, of the fire and miscellaneous clays reported as having been sold for the manufacture of stoneware might properly be classed as stoneware clay.

Fire clay, which constituted 73 per cent of the total quantity of clay sold by producers in 1929, increased 14 per cent in quantity and 8 per cent in value, as compared with 1928. The sales in 1929 were the largest ever recorded; they were 13 per cent greater than those in 1926, the previous record year, and 81 per cent greater in quantity and 75 per cent greater in value than those in 1919. As its name indicates, the chief use of fire clay is in the refractories industries. Considerable quantities are also used in the manufacture of sanitary ware, stoneware, high-grade tile, architectural terra cotta, saggers, and other heavy-clay products.

Miscellaneous clays embrace those used in many industries; the larger part of the output is used in the manufacture of heavy-clay products, such as building and drainage materials. Clay included under this head is also used for cosmetics, filtering oil (after chemical treatment), flower pots, foundries, modeling, taxidermy, water softening, and other purposes.

PRODUCTION

Clay sold by producers in the United States, 1920–1929, by kinds

Year	Kaolin or china clay and paper clay		Ball clay		Slip clay		Fire clay	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	268, 203	$2, 865, 407	69, 477	$584, 611	9, 006	$41, 519	2, 261, 915	$7, 088, 049
1921	162, 726	1, 579, 163	54, 014	354, 565	4, 608	14, 841	1, 195, 861	3, 560, 373
1922	275, 675	2, 346, 095	76, 792	440, 877	4, 050	19, 405	1, 679, 220	4, 633, 486
1923	336, 803	2, 926, 255	97. 068	620, 978	8, 520	43, 609	2, 298, 163	6, 565, 899
1924	326, 611	2, 923, 965	83, 034	581, 966	5, 910	31, 023	2, 443, 710	6, 737, 063
1925	367, 319	3, 220, 719	109, 607	699, 427	7, 349	37, 397	2, 566, 934	7, 312, 349
1926	432, 215	3, 771, 568	112, 195	867, 500	8, 644	45, 959	2, 819, 346	8, 119, 323
1927	454, 245	3, 809, 834	119, 763	913, 976	6, 137	32, 264	2, 699, 761	7, 719, 725
1928	496, 142	4, 088, 003	120, 878	984, 075	5, 699	30, 796	2, 785, 158	7, 480, 609
1929	518, 169	4, 281, 301	118, 190	987, 306	6, 369	38, 582	3, 178, 805	8, 107, 586

Clay sold by producers in the United States, 1920–1929, by kinds—Continued

Year	Stoneware clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	106, 350	$229, 221	322, 100	$467, 856	3, 037, 051	$11, 276, 663
1921	86, 574	184, 540	242, 963	361, 818	1, 746, 746	6, 055, 300
1922	86, 866	164, 870	525, 097	725, 781	2, 647, 700	8, 330, 514
1923	81, 389	194, 358	612, 717	837, 814	3, 434, 660	11, 188, 913
1924	59, 194	117, 142	772, 660	1, 116, 377	3, 691, 119	11, 507, 536
1925	77, 438	162, 161	901, 773	1, 304, 579	4, 030, 420	12, 736, 632
1926	84, 002	185, 288	510, 796	1, 115, 951	3, 967, 198	14, 105, 589
1927	98, 355	203, 648	470, 915	1, 017, 712	3, 849, 176	13, 697, 159
1928	95, 626	207, 275	522, 829	1, 409, 981	4, 026, 332	14, 200, 739
1929	87, 456	181, 901	438, 031	1, 254, 068	4, 347, 020	14, 850, 744

Clay sold by producers in the United States in 1928, by States and kinds

State	Number of operators reporting sales	Kaolin or china clay and paper clay		Ball clay		Fire clay		Stoneware clay		Miscellaneous clay [1]		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	13					124, 592	$173, 206			7, 216	$5, 728	131, 808	$178, 934
Arizona	1									11, 473	45, 892	11, 473	45, 892
Arkansas	1					266	1, 064					266	1, 064
California	40	800	$10, 873	3, 667	$17, 252	205, 990	511, 916	1, 312	$5, 493	127, 728	418, 309	339, 497	963, 843
Colorado	18					70, 110	167, 500			84, 965	89, 048	155, 075	256, 548
Connecticut	2					329	4, 277			450	1, 350	779	5, 627
Delaware	2	5, 638	84, 736									5, 638	84, 736
Florida	4	46, 496	630, 471									46, 496	630, 471
Georgia	17	234, 028	1, 668, 125			15, 486	19, 439	90	90			249, 604	1, 687, 654
Idaho	2					494	6, 095					494	6, 095
Illinois	23			(2)	(2)	224, 322	404, 071	21, 220	35, 970	(2)	(2)	248, 618	466, 290
Indiana	13					132, 087	163, 430			38, 425	38, 785	170, 512	202, 215
Iowa	5					2, 833	21, 900			1, 221	1, 600	4, 054	23, 500
Kentucky	18			53, 204	460, 778	(2)	(2)			(2)	(2)	149, 317	757, 505
Maine	3					89	1, 780			84	104	173	1, 884
Maryland	11			(2)	(2)	7, 119	34, 184			(2)	(2)	60, 762	91, 547
Massachusetts	7					(2)	(2)			(2)	(2)	2, 158	11, 848
Michigan	5									3, 805	6, 949	3, 805	6, 949
Minnesota	5							17, 727	39, 886	839	3, 687	18, 566	43, 573
Mississippi	1							1, 320	2, 310			1, 320	2, 310
Missouri	32			1, 440	10, 080	420, 586	1, 425, 564	4, 000	7, 000			426, 026	1, 442, 644
Montana	3					11, 954	63, 032			12, 589	10, 071	24, 543	73, 103
Nebraska	5					132	538			19, 020	19, 193	19, 152	19, 731
Nevada	4	918	7, 855							12, 591	53, 668	13, 509	61, 523
New Jersey	38			11, 377	74, 073	212, 514	963, 609	13, 082	61, 390	23, 769	34, 776	260, 742	1, 133, 848
New Mexico	5					5, 338	6, 597					5, 338	6, 597
New York	6					(2)	(2)			(2)	(2)	7, 214	37, 201
North Carolina	5	19, 788	298, 841			(2)	(2)	(2)	(2)			19, 898	298, 951
North Dakota	2	12	192			25	100			7	140	44	432
Ohio	64					269, 689	692, 706	27, 536	40, 895	6, 460	18, 706	303, 685	752, 307
Oregon	2					(2)	(2)	(2)	(2)			(2)	(2)
Pennsylvania	90	71, 552	383, 675			865, 024	2, 100, 469	(2)	(2)	(2)	(2)	971, 148	2, 532, 105
South Carolina	11	106, 828	925, 801			2, 258	73, 902			100	400	109, 186	1, 000, 103
South Dakota	1									1, 066	10, 660	1, 066	10, 660
Tennessee	9			39, 851	370, 181	(2)	(2)	(2)	(2)	30, 776	39, 574	123, 587	613, 554
Texas	9					2, 651	16, 803			507	2, 028	3, 158	18, 831
Utah	6					(2)	(2)			(2)	(2)	24, 897	156, 951
Vermont	1	(2)	(2)									(2)	(2)
Virginia	3	(2)	(2)			746	2, 717			(2)	(2)	9, 970	71, 147
Washington	7					5, 906	18, 925	(2)	(2)	(2)	(2)	35, 041	39, 632
West Virginia	(					41, 836	66, 621					41, 836	66, 621

Wisconsin	2									508	983	508	983
Wyoming	7					3	24			22,918	383,970	22,921	383,994
Undistributed		10,082	77,434	11,339	51,711	162,779	540,140	9,339	14,241	122,011	255,156	2,448	11,336
	509	496,142	4,088,003	120,878	984,075	[3] 2,785,158	[3] 7,480,609	95,626	207,275	[4] 528,528	[4] 1,440,777	4,026,332	14,200,739
Average value per ton			8.24		8.14		2.69		2.17				3.53

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[1] Includes ardmorite, bentonite, shale, etc. Slip clay is also included in this column as a matter of statistical convenience.

[2] Included under "Undistributed."

[3] These totals include 37,439 tons of diaspore and burley clay from Missouri, valued at $207,155.

[4] These totals include 5,699 tons of slip clay from Michigan and New York, valued at $30,796, or $5.40 a ton.

Clay sold by producers in the United States in 1929, by States and kinds

State	Number of operators reporting sales	Kaolin or china clay and paper clay		Ball clay		Fire clay		Stoneware clay		Miscellaneous clay [1]		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	12					106,568	$183,797			1,451	$1,343	108,019	$185,140
Arizona	1									(2)	(2)	(2)	(2)
Arkansas	2					574	2,883					574	2,883
California	40	1,086	$14,675	3,290	$14,070	180,809	440,272	1,504	$6,715	120,784	337,439	307,473	813,171
Colorado	18					128,426	180,888			33,582	34,521	162,008	215,409
Connecticut	2					301	5,134			215	645	516	5,779
Delaware	2	(2)	(2)									(2)	(2)
Florida	4	40,904	544,848									40,904	544,848
Georgia	15	274,825	2,084,219			13,665	14,672					288,490	2,098,891
Idaho	2					616	7,487					616	7,487
Illinois	22			(2)	(2)	235,219	479,974	23,548	37,188	(2)	(2)	264,332	553,797
Indiana	14					267,042	241,950			9,568	12,408	276,610	254,358
Iowa	6					3,193	23,141			7	140	3,200	23,281
Kentucky	20			52,808	480,697	100,810	312,402					153,618	793,099
Maine	3					130	2,870			40	82	170	2,952
Maryland	12			(2)	(2)	18,919	65,303			(2)	(2)	37,775	120,022
Massachusetts	8					328	8,809	34	323	11,429	16,585	11,791	25,717
Michigan	4									2,638	4,503	2,638	4,503
Minnesota	5					227	771	12,105	27,237	928	2,017	13,260	30,025
Mississippi	1							990	1,500			990	1,500
Missouri	32			1,630	14,552	490,069	1,770,896	6,000	12,000			497,699	1,797,448
Montana	4					6,488	11,313			12,632	12,632	19,120	23,945
Nebraska	6					200	700			16,809	19,174	17,009	19,874
Nevada	4	543	4,701							7,811	38,094	8,354	42,795
New Jersey	35			5,464	30,272	189,125	840,025	10,329	50,373	39,340	103,133	244,258	1,023,803
New Mexico	5					7,004	15,104			3,343	4,917	10,347	20,021
New York	8					498	7,452			7,657	38,101	8,155	45,553
North Carolina	2	17,678	282,672					5	10			17,683	282,682
North Dakota	1	9	212			19	57					28	269
Ohio	66					383,924	923,230	24,797	38,159	5,765	18,072	414,486	979,461
Oklahoma	1					31	153					31	153
Oregon	2					1,019	1,813	300	423			1,319	2,236
Pennsylvania	81	66,215	330,912			924,962	2,174,582	1,344	3,973	62,263	102,065	1,054,784	2,611,532
South Carolina	10	100,953	841,507			1,454	54,025			696	940	103,103	896,472
South Dakota	1									1,275	5,100	1,275	5,100
Tennessee	7			39,534	373,697	46,812	187,120			24,244	24,244	110,590	585,061
Texas	10					3,047	18,602			131	788	3,178	19,390
Utah	7	(2)	(2)			5,039	20,367			(2)	(2)	24,426	243,233
Vermont	1	1,550	11,890							1,089	4,783	2,639	16,673
Virginia	3	(2)	(2)			861	2,863			(2)	(2)	10,959	88,513
Washington	7					894	9,862	6,500	4,000	21,010	25,271	28,404	39,133

West Virginia	7					60, 530	99, 054					60, 530	99, 054
Wisconsin	1									500	500	500	500
Wyoming	7					2	15			22, 053	190, 156	22, 055	190, 171
Undistributed		14, 406	165, 665	15, 464	74, 018					37, 140	294, 997	13, 104	134, 810
	501	518, 169	4, 281, 301	118, 190	987, 306	[3] 3, 178, 805	[3] 8, 107, 586	87, 456	181, 901	[4] 444, 400	[4] 1, 292, 650	4, 347, 020	14, 850, 744
Average value per ton			8. 26		8. 35		2. 55		2. 08				3. 42

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[1] Includes ardmorite, bentonite, shale, etc. Slip clay is also included in this column as a matter of statistical convenience.

[2] Included under "Undistributed."

[3] These totals include 71,589 tons of diaspore and burley clay from Missouri, valued at $378,398.

[4] These totals include 6,369 tons of slip clay from Michigan and New York, valued at $38,582, or $6.06 a ton.

In 1929 operators in 44 States reported the sale of clay as such, an increase of one State as compared with 1928. Oklahoma appeared in 1929 for the first time as a seller of clay as such. The leading 10 States in order of quantity sold in 1929 were: Pennsylvania (24.3 per cent of the total of the United States), Missouri (11.4 per cent), Ohio (9.5 per cent), California (7.1 per cent), Georgia (6.6 per cent), Indiana (6.4 per cent), Illinois (6.1 per cent), New Jersey (5.6 per cent), Colorado (3.7 per cent), and Kentucky (3.5 per cent). Pennsylvania, Missouri, Illinois, Colorado, and Kentucky maintained the ranks they held in 1928—first, second, seventh, ninth, and tenth, respectively. Ohio rose from fourth to third, Georgia from sixth to fifth, and Indiana from eighth to sixth. California fell from third to fourth, and New Jersey from fifth to eighth. These leading 10 States reported 84.2 per cent of the total in 1929, and the first 5 of them reported 58.9 per cent of the total. In each of these States, except Georgia, sales of fire clay in 1929 constituted more than half of the total sales and ranged from 59 per cent in California to 98 per cent in Missouri. Of the 43 States in which clay was sold in both 1929 and 1928, 19 reported increase in quantity and 24 reported increase in total value.

PRODUCTION BY USES

Statistics showing the production of clay by uses are necessarily incomplete, as many clay miners do not know the purpose to which their clay is put, but it is believed that the figures given in the following table are sufficiently complete to serve as a guide in the study of the uses of domestic clays. In considering these figures it should be borne in mind that they represent chiefly the clay sold as clay by the original producers and do not include the much greater quantities of clay that are burned into clay products by those who mine their own clay.

Clay sold by producers in the United States, 1928 and 1929, by uses, in short tons

Use	1928							1929						
	Kaolin	Ball clay	Slip clay	Fire clay	Stoneware clay	Miscellaneous clay	Total	Kaolin	Ball clay	Slip clay	Fire clay	Stoneware clay	Miscellaneous clay	Total
White-bodied ware made from white-burning clays	59,183	65,465		8,970	1,371	25	135,014	69,468	66,629		9,829	881		146,807
Art pottery	7,825	120		243		450	8,638	3,454	2,256		316	450	275	6,751
High-grade tile	21,096	31,854		24,005	536	1,639	79,130	21,743	32,330		17,872	650	6,072	78,667
Chemical stoneware				1,150	7,763		8,913		873		1,669	7,275		9,817
Stoneware		1,046		5,737	62,741		69,524		481		5,479	58,945	886	65,791
Enameling	7	540					547		536		57			593
Paper filler	[1] 210,929					160	[1] 211,089	235,410			75			235,485
Paper coating	[1] 26,306						[1] 26,306	33,034						33,034
Rubber	36,654			1,295		116	38,065	34,296			1,927			36,223
Oilcloth or linoleum	13,036						13,036	14,648						14,648
Paint filler or extender	15,090			40		1,239	16,369	13,083	560				1,152	14,795
Paint pigment	35	508				100	643	180						180
Architectural terra cotta	200	9,000		80,360	13,233	3,233	106,026	100	8,316		46,635	12,362	20,314	87,727
Asbestos products	1,627	3,448		4,815			9,890	861	481		6,740		30	8,112
Plaster and plaster products	8,466	57		7,779			16,302	5,794			1,572		50	7,416
Slip for glazing purposes			2,137				2,137			1,822				1,822
Cement	45,328			5,438			50,766	42,552			11,043			53,595
Kalsomine	1,330			774			2,104	3,436			261			3,697
Artificial abrasives		56	3,562	1,202	1,598		6,418	1,000	49	4,547	1,298	853		7,747
Crayons	395						395	489						489
Chemicals								126						126
Saggers	2,674	6,792		[1] 126,424			[1] 135,890	4,283	1,324		146,291			151,898
Pins, stilts, and spurs for potters' use	300			[1] 5,004			[1] 5,304	250	900		951			2,101
Wads		1,015		[1] 32,288			[1] 33,303				35,896			35,896
Gas retorts				[1] 2,000			[1] 2,000							
Fire brick and block	29,487	160		1,099,738		3,700	1,133,085	22,873	502		1,254,115		4,870	1,282,360
Fire-clay mortar	2,849			320,284			323,133	2,182	1,242		403,265		216	406,905
Bauxite and high alumina brick				499			499				3,811			3,811
Glasshouse pots	150			25,091			25,241	150			49,108			49,258
Glasshouse supplies, blocks, tiles, etc		145		1,693			1,838	190	1,048		8,983			10,221
Zinc retorts and condensers				60,265			60,265				43,034			43,034
Clay crucibles	150	344		2,485			2,979	377			1,907			2,284
Graphite crucibles and stoppers									146					146
Foundries, steel works, etc	5,135			487,700		26,017	518,852	6,112			576,254		37,844	620,210
Unspecified [2]	7,890	328		479,879	8,384	486,150	982,631	2,078	517		550,417	6,040	366,322	925,374
	496,142	120,878	5,699	2,785,158	95,626	522,829	4,026,332	518,169	118,190	6,369	3,178,805	87,456	438,031	4,347,020

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[1] Revised figures.

[2] 1928: Includes clay for building brick, chimney tops, conduits, cosmetics, filler for cotton goods, filtering or decolorizing oil, flower pots, flue lining, hollow building tile, luting, matches, modeling, packing hoofs of horses, phonograph records, roofing tile, rotary drilling mud, sewer pipe, smelters, toy marbles, wall coping, waterproofing compound, and water softener; also black-burning clay; 1929: Includes clay for building brick, case hardening, conduits, converters, cosmetics, daubing oven doors, drain tile, enameled brick, filtering or decolorizing oil, flower pots, garden ornaments, high-temperature cement, hollow building tile, matches, modeling, packing hoofs of horses, roofing tile, sewer pipe, smelters, steel mills, stopping clay, taxidermy, toy marbles, wall plaster, water softener, and whiting.

IMPORTS AND EXPORTS[2]

Clay imported for consumption in the United States, 1920–1929

Year	Kaolin or china clay		Common blue and Gross Almerode glass-pot clay		All other clays				Total	
					Unwrought		Wrought			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	361, 800	$3, 568, 677	6, 837	$157, 201	34, 252	$272, 524	691	$10, 267	403, 580	$4, 008, 669
1921	162, 906	1, 546, 285	4, 468	77, 217	41, 421	348, 870	120	2, 313	208, 915	1, 974, 685
1922	310, 136	2, 963, 420	7, 323	84, 415	40, 624	327, 388	2, 566	29, 398	360, 649	3, 404, 621
1923	311, 298	3, 046, 191	12, 999	121, 272	65, 379	481, 614	1, 676	21, 892	391, 352	3, 670, 969
1924	353, 124	3, 188, 454	7, 059	62, 883	82, 562	706, 018	1, 322	18, 685	444, 067	3, 976, 040
1925	372, 552	3, 195, 694	11, 889	107, 940	49, 991	499, 325	2, 383	29, 266	436, 815	3, 832, 225
1926	396, 219	3, 484, 054	6, 608	60, 391	84, 512	672, 223	2, 331	31, 243	489, 670	4, 247, 911
1927	339, 014	2, 937, 113	3, 884	39, 451	50, 017	447, 888	1, 585	24, 518	394, 500	3, 448, 970
1928	307, 304	2, 962, 269	10, 259	90, 742	51, 163	429, 788	1, 653	23, 564	370, 379	3, 506, 363
1929	279, 981	2, 700, 296	28, 008	268, 011	49, 324	420, 689	12, 283	154, 158	369, 596	3, 543, 154

Imports of clay decreased slightly in quantity in 1929 as compared with 1928, but increased 1 per cent in value. Imports of kaolin, or china clay, which constituted 76 per cent of the total quantity imported in 1929 and came chiefly from England, decreased 9 per cent in both quantity and value as compared with 1928.

Domestic clay exported from the United States, 1920–1929

Year	Fire clay		All other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	54, 125	$393, 177	66, 035	$775, 222	120, 160	$1, 168, 399
1921	23, 666	177, 979	23, 779	183, 449	47, 445	361, 428
1922	24, 391	169, 664	[1] 23, 285	[1] 267, 908	47, 676	437, 572
1923	50, 055	303, 675	34, 840	329, 192	84, 895	632, 867
1924	41, 704	312, 676	31, 051	420, 040	72, 755	732, 716
1925	44, 037	350, 571	39, 006	530, 995	83, 043	881, 566
1926	47, 737	348, 302	42, 157	644, 416	89, 894	992, 718
1927	48, 106	392, 327	51, 278	725, 562	99, 384	1, 117, 889
1928	60, 138	494, 241	60, 911	896, 350	121, 049	1, 390, 591
1929	76, 561	588, 770	76, 789	1, 117, 312	153, 350	1, 706, 082

[1] Includes 2,091 short tons of "kaolin, china, and paper clay," valued at $27,840. Similar exports are not separately classified for other years.

The quantity of domestic clays exported increased 27 per cent in 1929 as compared with 1928 and was the highest ever recorded; the value increased 23 per cent and was also the highest ever recorded. Fire clay, which constituted 50 per cent of the total quantity of clay exported in 1929 and 35 per cent of the total value, increased 27 per cent in quantity and 19 per cent in value as compared with 1928.

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[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

GYPSUM[1]

By R. M. Santmyers and Jefferson Middleton

INTRODUCTION

The gypsum industry in 1929 was still affected by the severe competition and price cutting that have exerted an adverse influence since the latter part of 1926. Eventually, however, the producers were forced to make a determined effort to correct conditions, and as a result conditions improved considerably during the last three months of the year. Prices were advanced on the principal products, but these increases were not reflected to an appreciable extent in the total value of the gypsum sales during 1929 because in the last quarter sales dropped off sharply as a result of the general financial depression. The decrease in construction work using plaster was more pronounced than in any other field of construction; consequently gypsum sales suffered even more perhaps than those of other building materials.[2]

A number of new mills of improved design and efficiency began production in 1929; most of these mills are near large consuming markets. Competitive conditions have been particularly difficult, and the low prices prevailing for all gypsum products have forced the older and less economically operated plants either to close down or to plan reconstruction that will enable them to compete with the newer and more up-to-date plants.

PRODUCTION

The quantity of crude gypsum mined in the United States in 1929 was 5,016,132 short tons, a decrease of 86,118 tons, or 2 per cent, compared with 1928. The number of operators in 1929 was 59, an increase of 1 over 1928. The value of the sales of uncalcined and calcined gypsum by producers was $31,292,969 in 1929, as compared with $32,036,163 in 1928 and $42,174,454 in 1927—a decrease from 1928 of $743,194, or 2 per cent, and from 1927 of $10,881,485, or 26 per cent. Of the total quantity mined in 1929, 1,065,697 tons was sold without calcining (an increase of 66,285 tons over 1928) and was valued at $2,096,779 ($1.97 per ton, or 7 cents more than in 1928). The sales of calcined gypsum by producers in 1929 amounted to 3,361,580 short tons, valued at $29,196,190, or $8.69 per ton; this is a decrease of 8 per cent in quantity and 3 per cent in value but an increase of 41 cents per ton compared with 1928.

New York continued to be the largest producer of gypsum. Although the same number of operators (11) were active in the State as during 1928, the production of crude gypsum was only 1,284,338 tons, a decrease of 15 per cent from that in 1928. New York was also, as usual, the largest seller of gypsum, marketing 298,793 tons without calcining, or 28 per cent of the United States total, and 859,147 tons calcined, or 26 per cent of the total. These figures represent an increase of 11 per cent in quantity sold without calcining and a decrease of 20 per cent in quantity sold calcined as compared with sales in 1928. Other important States in the production of crude gypsum in 1929 were as follows: Michigan, 898,547 tons; Iowa, 718,503 tons; Texas, 520,519 tons; Ohio, 374,008 tons; Oklahoma, 369,433 tons; and Nevada, 225,514 tons. The leading five States reported 76 per cent of the total production.

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[1] Work on manuscript completed July, 1930.

[2] Rock Products, Gypsum Products in 1929: Jan. 4, 1930, p. 107.

The quantity of crude gypsum sold by producers in 1929 as agricultural gypsum was 38,099 tons, valued at $161,288, as compared with 25,668 tons, valued at $90,937, in 1928, an increase of 48 per cent in quantity and 77 per cent in value.

Gypsum mined and uncalcined and calcined gypsum sold by producers in the United States, 1920–1929

Year	Number of operators	Total quantity mined (short tons)	Sold without calcining		Sold calcined		Total value of sales
			Short tons	Value	Short tons	Value	
1920	61	3,129,142	669,260	$2,565,195	1,904,484	$21,967,870	$24,533,065
1921	62	2,890,784	642,944	2,266,011	1,796,851	21,434,279	23,700,290
1922	64	3,779,949	770,725	2,443,346	2,491,265	26,917,805	29,361,151
1923	62	4,753,448	847,242	2,577,436	3,101,378	32,310,719	34,888,155
1924	72	5,042,629	982,108	2,674,320	3,568,569	40,050,187	42,724,507
1925	61	5,678,302	1,014,135	2,823,229	4,096,357	44,754,011	47,577,240
1926	59	5,635,441	961,363	2,509,885	4,015,974	44,211,334	46,721,219
1927	60	5,346,888	965,371	2,388,663	3,912,211	39,785,791	42,174,454
1928	58	5,102,250	999,412	1,902,034	3,641,385	30,134,129	32,036,163
1929	59	5,016,132	1,065,697	2,096,779	3,361,580	29,196,190	31,292,969

Gypsum mined and uncalcined and calcined gypsum sold by producers in the United States, 1928 and 1929, by States

State	Number of operators	Total quantity mined (short tons)	Sold without calcining		Sold calcined		Total value of sales
			Short tons	Value	Short tons	Value	
1928							
Iowa	7	764,044	154,596	$247,263	565,140	$5,107,951	$5,355,214
Kansas	3	126,227	33,782	51,427	69,974	884,168	935,595
Michigan	5	677,108	199,036	243,891	460,143	2,915,478	3,159,369
Nevada	5	278,405	52,878	162,404	196,348	1,262,051	1,424,455
New York	11	1,504,826	268,691	636,645	1,068,222	8,976,662	9,613,307
Ohio	3	413,948	12,359	30,211	378,664	3,775,584	3,805,795
Oklahoma	3	397,752	(1)	(1)	(1)	(1)	2,021,635
Texas	4	509,472	34,521	52,989	400,015	3,041,156	3,094,145
Utah	3	28,103	(1)	(1)	(1)	(1)	136,766
Other States [2]	14	402,365	[3] 243,549	[3] 477,204	[3] 502,879	[3] 4,171,079	2,489,882
	58	5,102,250	999,412	1,902,034	3,641,385	30,134,129	32,036,163
1929							
Iowa	8	718,503	148,442	238,734	521,761	4,430,122	4,668,856
Michigan	5	898,547	213,657	299,249	481,872	4,016,085	4,315,334
Nevada	5	225,514	43,815	131,735	148,640	1,159,119	1,290,854
New York	11	1,284,338	298,793	707,644	859,147	7,632,208	8,339,852
Ohio	3	374,008	12,190	30,696	356,734	3,270,744	3,301,440
Oklahoma	3	369,433	(1)	(1)	(1)	(1)	2,255,374
Texas	4	520,519	29,991	47,836	416,276	3,392,451	3,440,287
Other States [2]	20	625,270	[3] 318,809	[3] 640,885	[3] 577,150	[3] 5,295,461	3,680,972
	59	5,016,132	1,065,697	2,096,779	3,361,580	29,196,190	31,292,969

[1] Included under "Other States."

[2] 1928: Arizona, California, Colorado, Montana, New Mexico, South Dakota, Virginia, and Wyoming. 1929: Arizona, California, Colorado, Kansas, Montana, New Mexico, South Dakota, Utah, Virginia, and Wyoming.

[3] This figure includes also sales from States entered as "(1)" above.

The amount of calcined gypsum sold during 1929 for building purposes was 3,125,066 tons, valued at $27,583,813, or 93 per cent of the quantity and 94 per cent of the value of the total sales of calcined gypsum; in 1928 the corresponding figures were 3,447,496 tons, valued at $28,983,564, or 95 per cent of the quantity and 96 per cent of the value. Sales of fibered plaster amounted to 1,597,846 tons, valued at $7,814,603—a little more than half (51 per cent) of the total quantity sold for building but only 28 per cent of the total value of such sales. Sales of wall board ranked second in quantity, amounting to 524,307 tons (618,829,362 square feet), valued at $10,538,811, or 17 per cent of the total quantity (in tons) sold for building purposes and 38 per cent of the total value. The third largest item in quantity was neat plaster, sales of which amounted to 300,459 tons, valued at $1,883,100, or 10 per cent of the total quantity sold for building and 7 per cent of the total value; these figures show a decided decrease from those for 1928, when 551,674 tons, valued at $3,284,293, was reported as having been sold. The sales of Keenes cement during 1929 were 52,330 tons, valued at $767,621, as compared with 54,020 tons, valued at $848,504, in 1928, a decrease of 3 per cent in quantity and 10 per cent in value.

The amount of calcined gypsum sold during 1929 for manufacturing uses was 236,514 tons, valued at $1,612,377, or 7 per cent of the quantity and 6 per cent of the value of the total sales of calcined gypsum. The largest item in quantity under this heading was plaster of Paris (molding and casting plaster, etc.), sales of which amounted to 102,801 tons, valued at $827,413, or 43 per cent of the total quantity sold for manufacturing uses and 51 per cent of the total value. The reported sales of calcined gypsum to plate-glass works in 1929 were 85,799 tons, valued at $596,489. Revised statistics show that sales of calcined gypsum to plate-glass works in 1928 reached 105,275 tons, valued at $544,158.

Gypsum sold by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Short tons	Value	Short tons	Value
Without calcining:				
To cement mills	969, 357	$1, 802, 164	1, 020, 234	$1, 914, 263
For agriculture	25, 668	90, 937	38, 099	161, 288
For other uses [1]	4, 387	8, 933	7, 364	21, 228
Total without calcining	999, 412	1, 902, 034	1, 065, 697	2, 096. 779
Calcined:				
For building purposes—				
Neat plaster	[2] 551, 674	[2] 3, 284, 293	300, 459	1, 883, 100
Sanded plaster	245, 617	1, 314, 480	129, 026	752, 528
Fibered plaster	1, 549, 483	7, 677, 864	1, 597, 846	7, 814, 603
Plaster board and lath	[3] 252, 813	4, 107, 848	[4] 236, 761	3, 591, 880
Wall board	[5] 459, 177	9, 046, 926	[6] 524, 307	10, 538, 811
Partition tile	218, 560	1, 675, 153	221, 899	1, 440, 538
Special tile and block	5, 856	70, 222	7, 445	98, 856
For insulating	12, 776	226, 605	10, 307	186, 830
Keenes cement	54, 020	848, 504	52, 330	767, 621
For other building purposes [7]	[2] 97, 520	[2] 731, 669	44, 686	509, 046
Total for building purposes	3, 447, 496	28, 983, 564	3, 125, 066	27, 583, 813
For manufacturing uses—				
Plaster of Paris (molding and casting, pottery, foundry, terra cotta, and architectural plaster)	67, 067	500, 582	102, 801	827, 413
To plate-glass works	[2] 105, 275	[2] 544, 158	85, 799	596, 489
For other manufacturing uses [8]	21, 547	105, 825	47, 914	188, 475
Total for manufacturing uses	193, 889	1, 150, 565	236, 514	1, 612, 377
Total calcined	3, 641, 385	30, 134, 129	3, 361, 580	29, 196, 190
Grand total value		32, 036, 163		31, 292, 969

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[1] 1928: Includes gypsum sold for soil corrective, poultry grits, and road work and to paint mills. 1929: Includes gypsum sold for insulating material, to paint mills, and as rock dust.

[2] Revised figures.

[3] 284,440,741 square feet.

[4] 267,215,128 square feet.

[5] 559,936,675 square feet.

[6] 618,829,362 square feet.

[7] 1928: Includes finished plaster, prepared finishes, board filler, roofing tile, etc. 1929: Includes finished plaster, prepared finishes, joint filler, roofing tile, sheet-rock finisher, etc.

[8] 1928: Includes dental plaster, etc. 1929: Includes stucco for plaster and wall board and for filler.

Keenes cement sold by producers in the United States, 1920–1929

Year	Manufacturers	Short tons	Value	Year	Manufacturers	Short tons	Value
1920	6	16,542	$246,433	1925	5	36,607	$503,397
1921	7	14,430	232,457	1926	4	42,436	603,781
1922	6	21,991	324,316	1927	4	41,431	674,698
1923	5	23,273	323,127	1928	6	54,020	848,504
1924	6	30,620	428,684	1929	6	52,330	767,621

KETTLES AND KILNS IN OPERATION

The following table gives a comparison of the number and distribution of kettles and kilns (rotary and vertical) in operation in 1928 and 1929. New York had 1 operator less in 1929 than in 1928; as a result there was a decrease of 2 kettles. Iowa operated with 1 kettle less in 1929 than in 1928, while Michigan increased the number of kettles in operation from 28 to 31. The total daily capacity increased from 26,370 short tons in 1928 to 27,390 tons in 1929, or 4 per cent.

Calcining kettles and kilns reported by gypsum producers in the United States, 1928 and 1929, by States

State	Number of producers	Kettles		Rotary kilns [1]		Total daily capacity (short tons)
		Number	Daily capacity (short tons)	Number	Daily capacity (short tons)	
1928						
California	3	(2)	(2)	(2)	(2)	800
Iowa	6	28	4,204			4,204
Kansas	3	(2)	(2)	(2)	(2)	790
Michigan	5	28	3,100			3,100
Nevada	3	13	1,500			1,500
New York	8	23	3,565	10	3,520	7,085
Ohio	3	11	2,410			2,410
Texas	4	23	2,162			2,162
Other States [3]	16	[4] 56	[4] 5,409	[4] 5	[4] 500	4,319
	51	182	22,350	15	4,020	26,370
1929						
California	3	(2)	(2)	(2)	(2)	850
Iowa	6	27	4,444			4,444
Michigan	5	31	3,696			3,696
Nevada	3	13	1,500			1,500
New York	7	21	2,890	10	3,680	6,570
Ohio	3	11	2,410			2,410
Texas	4	23	1,978			1,978
Other States [3]	19	[4] 62	[4] 5,522	[4] 7	[4] 1,270	5,942
	50	188	22,440	17	4,950	27,390

[1] Includes a few vertical kilns reported by one operator in California.

[2] Included under "Other States."

[3] 1928: Arizona, Colorado, Montana, New Mexico, Oklahoma, South Dakota, Utah, Virginia, and Wyoming; 1929: Arizona, Colorado, Indiana (crude gypsum from Michigan), Kansas, Montana, New Mexico, Oklahoma, South Dakota, Utah, Virginia, and Wyoming.

[4] This figure covers also States entered as "(2)" above.

PRICES AND MARKETS

According to figures published in Rock Products the price of crude crushed gypsum showed a slight increase in 1929 as compared with 1928. At Port Clinton, Ohio, during the latter part of the year the price advanced $1, while at Los Angeles it was quoted from $0.50

to $2 higher during the summer months. Ground gypsum, however, did not fare as well, the prices quoted in most instances being slightly under those in 1928. Agricultural gypsum and calcined stucco (plasters) likewise were quoted slightly under the prices of the preceding year. The prices for Keenes cement held fairly steady during the year, showing practically no deviation from those quoted for the same periods in 1928.

The prices of some gypsum products in March, June, and December, 1929, appear in the following table.

Gypsum prices, per short ton in carload lots, f. o. b. mill, in 1929 [1]

District	Crushed rock			Ground gypsum			Agricultural gypsum			Stucco, calcined			Keenes cement		
	Mar. 16	June 8	Dec. 7	Mar. 16	June 8	Dec. 7	Mar. 16	June 8	Dec. 7	Mar. 16	June 8	Dec. 7	Mar. 16	June 8	Dec. 7
Douglas, Ariz	----------	----------	----------	----------	----------	----------	$6.00	----------	----------	$14.50	----------	----------	$30.00	----------	----------
Los Angeles, Calif	----------	$3.50–5.00	----------	$7.50–9.50	$6.00–8.00	----------	7.50–9.50	$6.00–8.00	$7.00–9.50	8.50–10.00	$7.50–8.50	$7.00–9.50	29.00–34.00	$26.90	----------
San Francisco, Calif	----------	----------	----------	----------	----------	----------	9.00	9.00	----------	13.40	13.40	----------	----------	----------	----------
Centerville, Iowa	$3.00	----------	----------	10.00	----------	----------	15.00	----------	6.00	10.00	----------	7.00	----------	----------	----------
Grand Rapids, Mich	2.65	1.50–3.00	----------	4.00	4.00	----------	6.00	4.00	7.00	6.00	4.00–6.00	----------	22.75	19.00	$29.25
Gypsum, Ohio	1.70–3.00	1.70–3.00	----------	4.00	4.00	----------	6.00	6.00	----------	7.00–9.00	7.00–9.00	----------	24.50	24.50	----------
Port Clinton, Ohio	3.00	3.00	----------	4.00	----------	----------	6.00	6.00	----------	10.00	10.00	----------	30.15	30.15	----------
Seattle, Wash	----------	----------	$6.00	10.00	----------	$9.00	10.00	10.50	9.00	13.00	12.00	13.00	23.00	----------	----------
Winnipeg, Manitoba	5.00	5.00	5.00	5.00	5.00	----------	7.00	7.00	7.00	13.00	13.00	13.00	----------	----------	----------

[1] Rock Products.

IMPORTS AND EXPORTS[3]

IMPORTS

The imports of crude gypsum during 1929 amounted to 1,036,385 short tons, an increase of 7,569 tons over 1928. Canada was, as usual, the chief foreign source of supply, furnishing 947,331 tons, valued at $976,455, or 91 per cent of the total quantity imported and 92 per cent of the total value. Mexico furnished practically all the remainder. The gypsum rock imported from Canada is destined mainly for manufacture at plants along the Atlantic seaboard, although some gypsum and anhydrite is imported into Norfolk from Canada to be used as a fertilizer in the growing of peanuts. The Mexican rock goes to plants at Long Beach, Calif., and Seattle, Wash. Imports of ground or calcined gypsum decreased from 6,907 short tons, valued at $99,833, in 1928 to 4,979 tons, valued at $69,703, in 1929 (28 and 30 per cent, respectively). The value of the imports of manufactured plaster of Paris decreased from $87,314 in 1928 to $71,479 in 1929, or 18 per cent, while the imports of Keenes cement fell from 601 tons, valued at $13,729, in 1928 to 430 tons, valued at $11,327, in 1929, or 28 and 17 per cent, respectively. The total value of the imports of gypsum and gypsum products in 1929 was $1,213,383, as compared with $1,541,796 in 1928, a decrease of 21 per cent.

Figures on imports of gypsum and gypsum products, as recorded by the Bureau of Foreign and Domestic Commerce, are given in the two tables following:

Gypsum imported for consumption in the United States, 1920–1929

Year	Crude		Ground or calcined		Manufactured plaster of Paris (value)	Keenes cement		Total value
	Short tons	Value	Short tons	Value		Short tons	Value	
1920	282,486	$397,942	14,921	$179,191	$10,282	202	$5,338	$592,753
1921	266,796	364,318	4,495	55,109	33,072	184	6,836	459,335
1922	409,475	523,939	1,774	32,651	55,116	403	9,636	621,342
1923	448,129	629,203	5,133	77,716	41,317	418	11,543	759,779
1924	519,627	724,864	5,217	70,793	48,059	539	12,042	855,758
1925	634,423	915,888	10,759	140,941	56,724	449	11,294	1,124,847
1926	824,081	1,276,131	7,149	99,058	96,355	578	15,701	1,487,245
1927	828,619	1,167,581	8,650	114,947	89,096	655	16,202	1,387,826
1928	1,028,816	1,340,920	6,907	99,833	87,314	601	13,729	1,541,796
1929	1,036,385	1,060,874	4,979	69,703	71,479	430	11,327	1,213,383

Crude gypsum imported into the United States, 1927–1929, by countries

[General imports]

Country	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Algeria and Tunisia	2,219	$5,710	----------	----------	1	$55
Belgium	220	543	----------	----------	----------	----------
Canada	757,785	1,099,131	933,478	$1,242,781	947,331	976,455
China	----------	----------	2	9	----------	----------
Cuba	----------	----------	----------	----------	[a]	5
Germany	1	8	2,951	4,659	----------	----------
Hong Kong	6	114	6	104	3	80
Mexico	68,387	62,035	92,363	92,563	89,041	84,240
United Kingdom	1	40	16	804	9	39
	828,619	1,167,581	1,028,816	1,340,920	1,036,385	1,060,874

[a] Less than ½ ton.

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[3] Figures on imports and exports (unless otherwise indicated) compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Eight importers with 13 plants in 10 States—namely, California, Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Vermont, Virginia, and Washington—reported to the Bureau of Mines that they imported 1,017,791 short tons of crude gypsum in 1929, as compared with 954,000 tons in 1928, an increase of 7 per cent. These importers reported 83,681 tons of gypsum sold uncalcined, valued at $331,979, a decrease of 31 per cent in quantity and 26 per cent in value compared with 1928. The imported gypsum reported by these importers as sold calcined in 1929 amounted to 820,737 tons, valued at $7,842,523, an increase of 2 per cent in both quantity and value compared with 1928. Figures covering 1928 and 1929 are shown in the following table.

Foreign gypsum sold in the United States, 1928 and 1929, by uses, as reported to the Bureau of Mines by the importers

Use	1928		1929	
	Short tons	Value	Short tons	Value
Without calcining:				
To cement mills	86, 661	$268, 040	55. 418	$168, 225
For agriculture For other uses	34, 678	181, 206	28, 263	163, 754
Total without calcining	121, 339	449, 246	83, 681	331, 979
Calcined:				
For building purposes [1]—				
Neat plaster	132, 559	1, 622, 116	195, 486	2, 210, 338
Sanded plaster	83, 302	540, 324	67, 468	397, 404
Fibered plaster	389, 829	2, 610, 328	380, 569	2, 424, 971
Plaster board	49. 740	632, 489	62, 609	829, 153
Wall board	65. 124	1, 171, 613	87, 316	1, 651, 032
Partition tile	15, 993	127, 557	[3] 8, 270	[3] 133, 061
Other building purposes [2]	14, 435	189, 869		
For manufacturing uses—				
Plaster of Paris	51, 372	731, 718	19, 019	196, 564
For other manufacturing uses [4]	3, 566	31, 446	(3)	(3)
Total calcined	805, 920	7, 657, 460	820, 737	7, 842, 523
Grand total value		8, 106, 706		8, 174, 502

[1] Figures for 1928 are revised figures.

[2] 1928: Includes acoustical and finishing plasters. 1929: Includes gypsum for insulating use and acoustical plaster.

[3] Gypsum sold for "Other manufacturing uses" in 1929 included under gypsum sold for "Other building purposes"; Bureau of Mines not at liberty to publish figures.

[4] 1928: Includes filler, dental plaster, etc., and gypsum sold to plate-glass works. 1929: Includes gypsum sold to plate-glass works and for patching plaster.

EXPORTS

Exports of gypsum and gypsum products, 1922 to 1929, as classified by the Bureau of Foreign and Domestic Commerce, are shown in the following table.

Gypsum and gypsum products exported from the United States, 1922–1929 [1]

Year	Short tons	Value	Year	Short tons	Value
1922	7, 673	$178, 166	1926	19, 610	$576, 585
1923	8, 815	226, 423	1927 [2]	18, 429	471, 106
1924	10, 623	358, 425	1928 [2]	18, 788	416, 748
1925	16, 798	498, 616	1929 [2]	28, 809	512, 186

[1] Exports of gypsum not separately classified prior to 1922. For 1927 and earlier years the classification reads "Gypsum or plaster, crude, ground, calcined, and manufactures of." For 1928 and 1929 exports are recorded as follows: "Crude, crushed, or ground," 2,365 short tons, valued at $23,764, in 1928, and 4,230 tons, $30,870, in 1929; and "Plaster, calcined, and manufactures, n. e. s.," 16,423 tons, $392,984, in 1928, and 24,579 tons, $481,316, in 1929.

[2] Exports of wall board were as follows: 9,531,453 square feet, valued at $243,578, in 1927; 15,216,727 square feet, $403,227, in 1928; and 18,420,455 square feet, $442,983, in 1929. Figures for earlier years are not separately recorded.

REVIEW OF THE GYPSUM INDUSTRY

NEW PLANTS AND PLANT INCREASES

Construction of new plants during 1929 was limited chiefly to those completed by the United States Gypsum Co. This company placed its East Chicago (Ind.) plant in operation on July 15 and its Detroit and Philadelphia plants several months later. These three plants with those at New York and Boston are the most modern of gypsum-calcining plants, all of them using rotary kilns for calcining. Each of these plants manufactures gypsum products from raw materials brought by water from distant sources. The three eastern plants of this company (Philadelphia, Pa., Staten Island, N. Y., and Charlestown, Mass.) receive their crude rock from Walton, Nova Scotia, in ships operated by the Gypsum Packet Co., a subsidiary. The plants at East Chicago and Detroit use crude gypsum shipped by boat from Alabaster, Mich.

The Victor Plaster (Inc.), at Victor, N. Y., began operations in March, 1929. This company is specializing in crushed gypsum rock for use as a retarder in Portland cement.

DEVELOPMENTS IN THE INDUSTRY

No new gypsum companies were organized in 1929, although several changes took place in the industry.

The Niagara Gypsum Co.'s plant at Oakfield, N. Y., was taken over during the year by the United States Gypsum Co.

It was reported that the Texas Gypsum Products Co. was planning to build a plant at Finlay, Tex., for the manufacture of wall board, tile, and other gypsum products.

The Montana Gypsum Products Co., of Butte, Mont., was reported to have sold its gypsum holdings to Japanese capitalists.

Anticipating increased business in the near future, the Best Bros. Keene's Cement Co., Medicine Lodge, Kans., completed a comprehensive plan of plant additions and materially increased its sales force.

NEW PRODUCTS

Several new products consisting primarily of gypsum were introduced during the year and may lead to an increasing use of this mineral.

The United States Gypsum Co., which has been carrying on considerable experimental work with plasters, recently placed on the market an extremely hard dense plaster, suited primarily for architectural casting. On the West coast producers of gypsum products have developed a wall board that may be bent or folded to conform to structural needs. Gypsum lath that folds and is more or less flexible so as to simplify its application to intricately designed interior structures was also a new development. A new method for fastening wall board and lath to steel structural members was devised. Considerable research work was done to develop acoustical wall boards, and gypsum acoustical ducts that prevent the transmission of sound through ventilator shafts were placed on the market. Some companies are now producing artificial travertine, using gypsum as the principal material.

A process was patented for casting concrete objects in porous plaster molds. The plaster molds absorb a considerable portion of the water in the concrete mixture, resulting in a concrete object of great strength.

The manufacture of white cements having excellent cementing properties from anhydrite is receiving considerable attention and points the way to the economical use of enormous tonnages of material now considered waste.[4] Cements made by patented processes develop strengths of 500 to 550 pounds in 24 days and 800 pounds in 28 days and are hard enough to take a high polish. It is said that they can be calcined at fuel costs comparable with present practices in calcining ordinary gypsum.

In the Middle West and East the manufacture of gypsum lumber made considerable progress during the year, and it is reported that the future of this gypsum product is very promising.

WORLD PRODUCTION

The following table shows the output of gypsum by various countries from 1925 to 1929, as far as statistics are available:

World production of gypsum, 1925–1929, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [a]	1925	1926	1927	1928	1929
Algeria	72,842	74,070	74,512	79,874	107,221
Argentina [b]	42,775	36,121	52,111	41,606	([c])
Australia:					
New South Wales	301	830	1,506	12,761	10,585
South Australia	73,436	66,666	95,356	93,004	98,468
Victoria	14,751	10,381	21,169	10,728	13,407
Western Australia	3,109	3,981	6,782	4,282	5,374
Austria [d]	60,000	58,000	40,000	45,000	43,000
Canada	640,335	844,760	1,003,073	1,189,895	([e])
Chile	8,446	6,991	8,245	9,113	([c])
China	67,000	[f] 50,000	45,220	[f] 50,000	[f] 50,000
Cuba	([c])	([c])	([c])	23,950	25,400
Cyprus [g]	24,510	19,445	14,010	11,226	12,758
Estonia	5,060	4,828	12,172	7,982	8,093
France	2,330,640	2,177,950	([h])	([h])	([c])
Germany:					
Bavaria	57,884	45,690	59,772	54,482	60,192
Prussia	405	262	538	452	402
Greece	10,060	9,723	2,014	----------	([c])
India, British	36,826	35,026	38,717	59,998	([c])
Italy	673,532	655,548	673,931	640,587	([c])
Japan	58,537	264,989	75,498	68,515	([c])
Latvia [g]	12,355	21,616	24,463	28,020	26,875
Luxemburg	24,951	33,984	7,848	2,506	7,206
New Caledonia	15,000	20,000	10,000	15,000	([c])
Peru	[i] 14,644	16,004	13,225	20,148	[i] 15,299
Philippine Islands	2,000	387	----------	----------	([c])
Poland	([c])	17,676	([c])	([c])	([c])
Rumania	53,845	44,316	77,724	47,785	([c])
Russia [j]	169,023	291,598	283,002	([c])	([c])
Spain	589,431	731,369	911,346	1,054,018	975,662
Sweden	128	137	89	50	([c])
Tunisia	11,600	13,070	16,000	16,000	19,540
Union of South Africa	7,237	11,389	15,430	14,871	17,245
United Kingdom:					
Great Britain	420,952	472,567	514,364	644,831	981,566
Northern Ireland	231	90	113	17	([c])
United States	5,151,242	5,112,359	4,850,590	4,628,659	4,550,535
Yugoslavia [k]	----------	620	1,063	1,170	2,340
	10,700,000	11,200,000	11,100,000	11,100,000	([c])

[a] Gypsum is also produced in Switzerland where large beds are privately worked, but no statistics are available.

[b] Rail and river shipments.

[c] Data not available.

[d] Estimate furnished by Bundesministerium für Handel und Verkehr.

[e] Data for crude gypsum mined not available. Shipments of crude (lump, crushed, and ground) and calcined gypsum amounted to 1,098,942 metric tons.

[f] Approximate production.

[g] Exports.

[h] Data not available; estimate included in world total.

[i] Sales and shipments.

[j] Year ended Sept. 30.

[k] Serbia only.

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[4] Rock Products, Some Developments in the Gypsum Industry During 1929: Vol. 33, Jan. 4, 1930, p. 111.

CANADA

PRODUCTION

The production (shipments) of gypsum in Canada in 1929 amounted to 1,211,383 short tons, valued at $3,338,859, as follows: Lump or run-of-mine, 44,465 tons, valued at $83,234; crushed, 964,875 tons, valued at $1,147,289; fine ground, 2,201 tons, valued at $17,271; and calcined, 199,842 tons, valued at $2,091,065.

The following tables set forth these figures in comparison with those for previous years:

Gypsum trade in Canada, 1927–1929 [1]

	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Production (shipments):						
By classes—						
Crude—						
Lump or run-of-mine	225, 264	$371, 488	43, 224	$80, 467	44. 465	$83, 234
Crushed	665, 499	1, 223, 070	1, 018, 172	1, 770, 077	964, 875	1, 147, 289
Fine ground	7, 065	42, 633	9, 576	55, 170	2, 201	17, 271
Calcined	165, 289	1, 613, 824	175, 396	1, 837, 934	199, 842	2, 091, 065
	1, 063, 117	3, 251, 015	1, 246, 368	3, 743, 648	1, 211, 383	3, 338, 859
By Provinces—						
Nova Scotia	829, 438	1, 512, 015	1, 013, 257	1, 850, 243	948, 736	1, 146, 499
New Brunswick	85, 293	524, 550	75, 033	501, 252	70, 482	485, 982
Ontario	83, 998	500, 688	85, 811	553, 271	100, 347	832, 689
Manitoba	39. 895	512, 008	51, 285	609, 039	67, 269	631, 051
British Columbia	24, 493	201, 754	20, 982	229, 843	24, 549	242, 638
	1, 063, 117	3, 251, 015	1, 246, 368	3, 743, 648	1, 211, 383	3, 338, 859
Imports:						
Crude gypsum	1, 092	42, 741	1, 097	40, 312	1, 244	18, 671
Ground, not calcined	111	2, 996	256	7, 379	165	5, 283
Calcined	7, 016	101, 823	10, 563	142, 550	16, 356	189, 438
	8, 219	147, 560	11, 916	190, 241	17, 765	213, 392
Exports:						
Crude gypsum	588, 808	959, 858	824, 536	1, 240, 987	893, 445	1, 086, 939
Plaster of Paris, prepared wall plaster	6, 556	113, 049	8, 232	140, 946	7, 938	137, 046
	595, 364	1, 072, 907	832, 768	1, 381, 933	901, 383	1, 223, 985

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[1] Preliminary Report on the Mineral Production of Canada, Ottawa.

Gypsum shipped in Canada, 1920–1929, by Provinces [1]

Year	Nova Scotia		New Brunswick		Ontario		Manitoba		British Columbia		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	260, 661	$573, 752	49, 405	$428, 183	74, 707	$404, 162	44, 371	$487, 894			429, 144	$1, 893, 991
1921	206, 831	511, 883	54, 030	360, 220	84, 790	433, 053	40, 859	480, 282	40	$100	386, 550	1, 785, 538
1922	332, 404	580, 148	82, 462	517, 668	110, 227	621, 668	34, 072	440, 914	100	500	559, 265	2, 160, 898
1923	341, 705	747, 934	104, 740	564, 680	99, 958	542, 317	31, 575	386, 554	323	1, 615	578, 301	2, 243, 100
1924	441, 752	915, 845	86, 738	476, 804	88, 121	467, 097	29, 375	348, 212	30	150	646, 016	2, 208, 108
1925	551, 230	1, 070, 408	71, 745	408, 917	82, 020	491, 833	35, 088	417, 868	240	865	740, 323	2, 389, 891
1926	678, 107	1, 187, 918	59, 546	468, 411	89, 987	496, 059	35, 172	461, 461	20, 916	156, 964	883, 728	2, 770, 813
1927	829, 438	1, 512, 015	85, 293	524, 550	83, 998	500, 688	39, 895	512, 008	24, 493	201, 754	1, 063, 117	3, 251, 015
1928	1, 013, 257	1, 850, 243	75, 033	501, 252	85, 811	553, 271	51, 285	609, 039	20, 982	229, 843	1, 246, 368	3, 743, 648
1929	948, 736	1, 146, 499	70, 482	485, 982	100, 347	832, 689	67, 269	631, 051	24, 549	242, 638	1, 211, 383	3, 338, 859

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[1] Preliminary Report on the Mineral Production of Canada, Ottawa.

Crude (lump, crushed, and ground) and calcined gypsum shipped in Canada, 1920–1929, by classes [1]

Year	Crude						Calcined			Total		
	Lump and crushed			Ground								
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton		Total	Average per ton
1920	310, 821	$604, 105	$1. 94	6, 615	$46, 584	$7. 04	111, 708	$1, 243, 302	$11. 13	429, 144	$1, 893, 991	$4. 41
1921	262, 349	518, 747	1. 98	7, 020	24, 029	3. 42	117, 181	1, 242, 762	10. 61	386, 550	1, 785, 538	4. 62
1922	418, 831	688, 357	1. 64	5, 769	35, 880	6. 22	134, 665	1, 436, 661	10. 67	559, 265	2, 160, 898	3. 86
1923	450, 313	837, 648	1. 86	7, 452	45, 719	6. 14	120, 536	1, 359, 733	11. 28	578, 301	2, 243, 100	3. 88
1924	520, 880	946, 976	1. 82	5, 478	31, 882	5. 82	119, 658	1, 229, 250	10. 27	646, 016	2, 208, 108	3. 42
1925	579, 378	1, 018, 947	1. 76	5, 993	35, 843	5. 98	154, 952	1, 335, 101	8. 62	740, 323	2, 389, 891	3. 23
1926	728, 395	1, 228, 428	1. 69	5, 874	36, 813	6. 27	149, 459	1, 505, 572	10. 07	883, 728	2, 770, 813	3. 14
1927	890, 763	1, 594, 558	1. 79	7, 065	42, 633	6. 03	165, 289	1, 613, 824	9. 76	1, 063, 117	3, 251, 015	3. 06
1928	1, 061, 396	1, 850, 544	1. 74	9, 576	55, 170	5. 76	175, 396	1, 837, 934	10. 48	1, 246, 368	3, 743, 648	3. 00
1929	1, 009, 340	1, 230, 523	1. 22	2, 201	17, 271	7. 85	199, 842	2, 091, 065	10. 46	1, 211, 383	3, 338, 859	2. 76

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[1] Preliminary Report on the Mineral Production of Canada, Ottawa.

In 1929 Nova Scotia, as usual, accounted for the larger part of the gypsum produced in Canada, furnishing 948,736 tons, valued at $1,146,499. This quantity represents 78 per cent of the total quantity; as most of the crude rock produced in Nova Scotia is destined for further fabrication in the United States and the values are those shown by the shipping companies involved, the value represents only 34 per cent of the total for the Dominion.

Ontario is the second largest producer of gypsum in Canada, its shipments during 1929 amounting to 100,347 tons, valued at $832,689. These shipments are practically all consumed in the gypsum industry in Canada; none of the crude rock is shipped to the United States. Ontario produced 8 per cent of the total quantity and 25 per cent of the total value of the shipments of gypsum in Canada during 1929.

The third largest producer is New Brunswick; in 1929 this Province shipped 70,482 tons, valued at $485,982, or 6 per cent of the total quantity and 15 per cent of the total value.

The gypsum industry in Manitoba and British Columbia has been growing rapidly during recent years. The output of Manitoba amounted in 1929 to 67,269 tons, valued at $631,051, and that of British Columbia to 24,549 tons, valued at $242,638. The shares of these two Provinces in the total Canadian production in 1929 were as follows: Manitoba, 6 per cent of the quantity and 19 per cent of the value; British Columbia, 2 per cent of the quantity and 7 per cent of the value.

EXPORTS AND IMPORTS

The larger part of the production of crude gypsum in Canada, especially that from Nova Scotia, is destined for calcining plants in the United States. Most of these plants, which are along the Northern Atlantic seaboard, rely entirely upon crude gypsum imported from Canada.

In 1929 Canada exported 893,445 short tons of gypsum, valued at $1,086,939, or 74 per cent of the total quantity produced and 33 per cent of its value. Virtually all of the gypsum exported came from Nova Scotia.

The following tables show the foreign trade of Canada in crude gypsum and calcined gypsum products:

Gypsum imported into Canada, 1920–1929 [1]

Year	Crude gypsum		Ground gypsum		Plaster of Paris	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	2,294	$35,477	118	$3,966	2,822	$48,859
1921	2,952	31,303	41	2,427	2,635	42,325
1922	2,872	21,040	148	5,592	3,657	49,015
1923	3,654	39,336	78	3,253	3,617	54,591
1924	3,252	63,156	102	2,174	3,969	62,770
1925	4,433	66,064	119	3,858	4,369	66,386
1926	933	32,442	209	6,846	5,156	79,853
1927	1,092	42,741	111	2,996	7,016	101,823
1928	1,097	40,312	256	7,379	10,563	142,550
1929	1,244	18,671	165	5,283	16,356	189,438

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[1] Preliminary Report on the Mineral Production of Canada, Ottawa.

Crude gypsum exported from Canada, 1920–1929 [1]

Year	Short tons	Value	Per cent of total quantity shipped	Year	Short tons	Value	Per cent of total quantity shipped
1920	244,428	$413,522	57	1925	533,646	$861,468	72
1921	230,011	417,502	60	1926	668,064	1,069,123	76
1922	325,354	505,464	58	1927	588,808	959,858	55
1923	397,329	578,859	69	1928	824,536	1,240,987	66
1924	472,236	747,829	73	1929	893,445	1,086,939	74

[1] Preliminary Report on the Mineral Production of Canada, Ottawa.

NOTES ON CANADIAN PLANTS AND DEPOSITS [5]

During the year the Western Gypsum Products (Ltd.) began construction of a modern mill in Winnipeg for the manufacture of gypsum products; the company plans to obtain its raw product from a deposit about 30 miles south of Gypsumville, Manitoba. The mill is expected to be in operation in the near future.

The Gypsum, Lime & Alabastine, Canada (Ltd.), formerly the Canada Gypsum & Alabastine (Ltd.), announced the erection of a mill at Calgary, Alberta, in which a full line of gypsum products will in time be manufactured. The company, at present, intends to obtain its supply of gypsum from Falkland, British Columbia, but later will open up deposits at Wardner, British Columbia, on the Crow's Nest Pass line of the Canadian Pacific Railway.

Extensive deposits occur in northern Ontario, and with the extension of the Temiskaming & Northern Ontario Railway now under construction to James Bay these deposits may become producers.

Interest is also being shown in the gypsum areas adjacent to the operating deposits south of Hamilton, Ontario, but no new properties have been opened as yet. The deposits in Alberta, although at a distance from markets and railway transportation, are of good grade.

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[5] Canadian Mineral Industry in 1929, Mines Branch, Ottawa, 1930.

MAGNESIUM AND ITS COMPOUNDS[1]

By PAUL M. TYLER[2]

INTRODUCTION

Magnesium is one of the major constituents of the earth's crust; it is the eighth most abundant element.[3] Less than two decades ago the metal itself was more or less a curiosity and was used almost exclusively in photography or in chemical laboratories. Only within the last 10 years, in fact, has it found extensive application as a structural metal, and until five years ago the sales of the metal in the United States were quite small, seldom exceeding 50 tons in any one year. In 1929, however, the domestic output of magnesium was 665 short tons, and the sales were greater than those of many of the other so-called minor metals, including mercury, cobalt, and bismuth.

Despite the growing importance of the element as a commercial metal, magnesium minerals are still classed as essentially nonmetallic in character and not as ores. Magnesite, the normal carbonate of magnesium, and dolomite, or high-magnesium limestone, are no longer the sources of the metal, as it is now made exclusively—both in this country and abroad—from the natural salts. Magnesium is used principally in the form of its compounds. The manufactured compounds considered in this report include the basic or technical carbonate, caustic calcined and dead-burned magnesite, dead-burned dolomite, and precipitated carbonate and salts derived from magnesite or dolomite or crude salts.

The dolomite considered in this report is that used because of its magnesium content. For many purposes dolomite is an active competitor of magnesite. In the manufacture of carbon dioxide and in the sulphite process of paper manufacture—the main outlets for domestic magnesite previous to 1914—magnesite has been largely displaced by cheaper dolomite or limestone. Specially selected calcined magnesite was formerly employed extensively by an American company in the manufacture of metallic magnesium, but now the metal is made from magnesium chloride both in this country and abroad. In the chemical industry magnesite may displace lime as a neutralizing agent and precipitant in the manufacture of stearin, glycerol, and soap. In the explosives industry it may be used as an absorbent in dynamite. It has been used also as a filler in automobile tires. Certain varieties of vitreous porcelain are made with magnesite. As oxychloride cement adheres firmly to wood, its use has been suggested for protecting railway ties. Other uses of magnesite, for many of which dolomite may also be employed, are as follows: In the manufacture of refractory brick, shapes, crucibles, and furnace hearths, for which dead-burned magnesite and dead-burned dolomite are used; in the manufacture of oxychloride (Sorel) cement, made from a mixture of caustic calcined magnesite and magnesium chloride; in the manufacture of medicinal and toilet preparations, made from magnesite, dolomite, and natural magnesium sulphate; as pipe covering (mixed with asbestos), made in this country mainly from dolomite (except on the Pacific coast); as an accelerator in the vulcanization of rubber; in the form of fused magnesia for insulation at exceedingly high temperatures; as an adulterant of paint; and in many other less important avenues of consumption.

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[1] Work on manuscript completed June, 1930.

[2] Unless otherwise stated, the statistics in this report were prepared by A. E. Davis, and the data on imports were compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

[3] Clarke, F. W., Data of Geochemistry: U. S. Geol. Survey Bull. 770, 1924, p. 29.

MAGNESITE

Crude magnesite is the natural carbonate of magnesium, which when pure contains 47.6 per cent of MgO and 52.4 per cent of CO_2. Dead-burned magnesite is obtained by calcining crude magnesite at a temperature high enough (usually above 1,500° C.) to drive off practically all of the carbon dioxide. Ordinarily the grades of magnesite chosen for this purpose contain 5 per cent or more of iron oxide, which sinters with magnesium oxide and forms lumps or so-called "grain" magnesite varying in size of particles from sand up to kernels about 1 inch in diameter. Dead-burned magnesite is employed as a refractory; about half of the domestic consumption is used in the form of brick and special shapes and the other half is purchased in loose condition by the furnace companies. Caustic calcined magnesite is calcined at a temperature low enough to retain about 3 per cent of CO_2 in the product. In this form the residual magnesia combines readily with water and carbon dioxide in the air and with various acids for the manufacture of salts.

In the refractory field magnesite meets active competition not only from dead-burned dolomite but also from other highly refractory mineral products. The demand for high-duty refractories has grown rapidly, however, and although magnesite may not have forged ahead recently quite as rapidly as chromite, for example (due in part to the higher prices for magnesite in the United States since it became dutiable in 1922), it is used in steadily increasing quantities. A comparatively new field has been found for it in the form of nearly pure magnesia refractories made from California magnesite, relatively free from iron and other more fusible impurities and employed especially in electric furnaces. Refractories of the mullite type, notably kyanite, have been introduced into industry but there is no indication as yet that they will soon become a competitive factor in large-tonnage business.

The market for caustic calcined magnesite is even more highly competitive. For outside stucco white Portland cement has almost wholly replaced magnesite. Magnesite flooring has much to recommend it but it is expensive, costing perhaps as much as 30 cents a square foot laid down in one of the large New York office buildings, whereas more or less desirable floorings including rubber and asphalt-base patent floorings cost 20 cents or less a square foot. Magnesite terrazzo can now be placed over old wooden floors in the form of a veneer ⅝ to ¾ inch thick. Patented brass strips may be inserted and the appearance of travertine may be simulated. Such floors not only withstand vibration and bending stresses without cracking but are "nonslipping" even when wet. Magnesite wall board is used in some quantity, and lath, tacking strips, shingles, and other forms of magnesite "lumber" are receiving considerable attention. In the State of Washington one of the magnesite mining companies proposed near the end of the year to build a plant to produce "heraklith," a special mixture of wood fiber and magnesite cement. Similar plants are operating in Germany and Australia, but this appears to be the first important step in the United States toward introducing magnesite to compete actively in the field now occupied largely by gypsum. "Solidon," a prepared magnesite plaster shipped in drums and containing just the right amount of magnesium chloride, is now available for interior use. At the present time, however, the mainstay of the caustic calcined magnesite business is the flooring trade. As the installation of such floors demands expensive equipment as well as considerable experience, the tendency is toward concentration of the trade into larger and stronger units.

DOMESTIC PRODUCTION

In 1929 mines in the United States produced 187,660 short tons of crude magnesite, valued (arbitrarily) at $1,500,000, an increase of nearly 48 per cent in quantity and 37 per cent in value as compared with 1928. This is the largest recorded quantity mined in the United States since 1920. The value for the total crude magnesite is determined by arbitrary valuations f. o. b. shipping points. In 1929, as in 1928, most of the production in Washington was sold as dead-burned magnesite; in California the proportion of dead-burned material, which had constituted approximately one-third of the sales by producers in 1928, was even larger in 1929.

Four producers operated in California in 1929, one each in San Benito, Santa Clara, Stanislaus, and Tulare Counties. The entire output in Washington was from the mines of the Northwest Magnesite Co., near Chewelah, Stevens County; this company operated two of its six kilns most of the year and two others part of the time.

Domestic magnesite (expressed as equivalent crude) sold or treated in the United States, 1920–1929

Year	California		Washington		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	81,782	$1,083,262	221,985	$1,664,888	303,767	$2,748,150
1921	47,904	510,177	------	------	47,904	510,177
1922	[1] 55,790	[1] 571,745	(1)	(1)	55,790	571,745
1923	73,350	938,600	73,900	165,100	147,250	1,103,700
1924	67,240	901,700	52,860	139,600	120,100	1,041,300
1925	64,600	872,100	56,060	560,600	120,660	1,432,700
1926	53,940	604,130	79,560	596,700	133,500	1,200,830
1927	43,750	507,500	77,740	583,050	121,490	1,090,550
1928	41,300	454,300	85,900	644,250	127,200	1,098,550
1929	[1] 187,660	[1] 1,500,000	(1)	(1)	187,660	1,500,000

[1] Washington included with California. Bureau of Mines not at liberty to publish figures.

Magnesite of domestic origin sold, 1922–1929

Year	Crude			Caustic calcined			Dead-burned		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average
1922	1,300	$13,330	$10.25	21,990	$813,630	$37.00	2,200	$51,260	$23.30
1923	6,020	78,260	13.00	28,470	1,035,740	36.38	34,410	671,000	19.50
1924	1,570	20,410	13.00	26,520	883,120	33.30	29,830	787,500	26.40
1925	2,090	26,290	12.58	23,900	782,700	32.75	29,110	923,960	31.74
1926	1,540	17,440	11.32	18,580	596,370	32.10	42,540	1,089,680	25.62
1927	1,800	17,130	9.52	13,890	452,810	32.60	40,210	990,300	24.63
1928	620	5,690	9.18	13,310	454,820	34.17	45,230	1,076,310	23.80
1929	--------	--------	--------	11,390	405,020	35.56	78,700	1,542,840	19.60

CRUDE MAGNESITE

In 1929 no sales of crude magnesite were reported by producers, whereas in 1928 sales of crude magnesite from domestic mines amounted to 620 short tons, valued at $5,690.

CAUSTIC CALCINED MAGNESITE

The domestic caustic calcined magnesite sold in 1929 amounted to 11,390 short tons, a decrease of 14 per cent as compared with 1928. Producers reported a few sales of high-grade calcined magnesite at as high as $45 per ton, but sales of the same material were made at as low as $36. One or two of the companies reported that the prices they received in 1929 were somewhat lower than those obtained in 1928, but an increase in the proportion of high-quality material resulted in an increase in the average value of sales of caustic calcined magnesite in California to $35.94 in 1929, as compared with only $34.23 in 1928. California produced most of the caustic calcined magnesite in 1929 as in the past. The producers of caustic calcined magnesite in 1929 were C. S. Maltby, the California Magnesite Co., the Sierra Magnesite Co., and the Northwest Magnesite Co.

DEAD-BURNED MAGNESITE

The domestic dead-burned magnesite sold in the United States in 1929 amounted to 78,700 short tons, an increase of 74 per cent as compared with 1928. The price of high-grade dead-burned magnesite as reported by producing companies ranged from a minimum of $25 to a maximum of $48 per ton f. o. b. California mines, according to quality; the average was $36.80. By far the bulk of the dead-burned output in 1929 was produced in Washington, but the production of sintered magnesite in California continued to grow. Much of the California product was artificial periclase for use as a high-grade refractory. The producers of dead-burned magnesite in 1929 were the Northwest Magnesite Co., C. S. Maltby, the Sierra Magnesite Co., and the Sampson Magnesite Co.

The companies in California and Washington producing magnesite in 1929 were as follows:

California:
  C. S. Maltby, 785 Market Street, San Francisco.
  Sierra Magnesite Co., Porterville.
  California Magnesite Co., 1 Montgomery Street, San Francisco.
  Sampson Magnesite Co., 803 Balfour Building, San Francisco.
Washington: Northwest Magnesite Co., executive office, Farmers Bank Building, Pittsburgh, Pa.; property and operating office, Chewelah, Wash.

MARKET AND PRICES

Throughout the year the Engineering and Mining Journal quoted grade A caustic calcined magnesite (80 per cent through 200-mesh) at $43 and grade B at $40 per short ton, f. o. b. California mines. The price of crude was nominally $11. Dead-burned magnesite was quoted at $29, f. o. b. California mines, and $22 to $24 per short ton, f. o. b. Chewelah, Wash.

IMPORTS

Imports of magnesite in 1929 were 300 short tons of crude, valued at $3,179; 6,500 tons of caustic calcined, valued at $145,844; and 50,379 tons of dead-burned, valued at $731,246. As compared with 1928 these figures represent a decrease of 462 tons in the imports of crude, an increase of 1,026 tons in the imports of caustic calcined, and a decrease of 6,628 tons in the imports of dead-burned.

Magnesite imported into the United States, 1925–1929, by countries, in short tons

[General imports]

Country	1925	1926	1927	1928	1929
Africa, British South	34				
Austria		7,028	39,752	34,997	31,908
Belgium	433	303	187	25	22
Canada	95	41	213	45	
Czechoslovakia	100	1,688	9,666	21,876	12,520
Denmark		360			
Germany	275	169	74	358	59
Greece	408	594	840	760	310
India, British	9,933	9,223	5,795	3,426	4,259
Italy	51,521	68,269	317		1,634
Kwantung		25			
Netherlands	4,752	3,944	3,167	1,959	2,055
Norway	23				
Poland and Danzig			(1)		
Soviet Russia in Europe					276
United Kingdom	1,543	902	213	56	139
	69,117	92,546	60,224	63,502	53,182

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[1] 1,100 pounds.

Magnesite imported into the United States, 1928 and 1929

[General imports]

Country	Crude		Caustic calcined		Dead-burned and grain (not suitable for manufacture into oxychloride cements)	
	Pounds	Value	Pounds	Value	Pounds	Value
1928						
Austria					69,993,002	$504,100
Belgium			49,221	$840		
Canada					90,800	1,135
Czechoslovakia					43,752,554	323,374
Germany			22,045	682	693,574	7,777
Greece	1,520,000	$6,088				
India, British	158,688	1,329	6,693,220	69,340		
Netherlands			3,918,773	57,222		
United Kingdom	4,658	176	106,400	2,806		
	1,683,346	7,593	10,789,659	130,890	114,529,930	836,386
1929						
Austria					63,815,456	452,489
Belgium			43,210	850		
Czechoslovakia					25,039,129	194,814
Germany			29,994	1,234	88,925	896
Greece	564,443	2,898	55,385	622		
India, British			8,519,420	76,002		
Italy					3,268,624	16,051
Netherlands			4,110,189	59,668		
Soviet Russia in Europe					552,252	5,916
United Kingdom	35,000	281	242,542	7,498		
	599,443	3,179	13,000,740	145,874	92,764,386	670,166

Magnesite imported for consumption in the United States, 1920–1929

Year	Crude		Calcined	
	Short tons	Value	Short tons	Value
1920	33,550	$406,204	14,780	$373,165
1921	51,993	525,452	6,788	250,932
1922	73,331	976,283	72,265	1,267,622
1923	5,182	44,081	72,955	1,022,968
1924	6	85	64,785	1,172,403
1925	487	6,382	68,395	1,160,830
1926	608	6,555	90,293	1,438,765
1927	856	8,574	59,261	946,361
1928	762	6,264	62,481	966,183
1929	300	3,179	56,879	877,090

ANNUAL SUPPLY

The annual additions to supply of magnesite may be considered as domestic sales plus imports, as exports are negligible. Although such figures take no account of stocks at grinding mills and in consumers' hands, they do furnish a fairly accurate index of consumption.

Magnesite supply in the United States, 1923–1929, in short tons

Year	Crude			Caustic calcined			Dead-burned		
	Domestic (sales)	Imports for consumption	Total new supply	Domestic (sales)	Imports for consumption	Total new supply	Domestic (sales)	Imports for consumption	Total new supply
1923	6,020	5,182	11,202	28,470	11,229	39,699	34,410	61,726	96,136
1924	1,570	6	1,576	26,520	16,134	42,654	29,830	48,651	78,481
1925	2,090	487	2,577	23,900	17,075	40,975	29,110	51,320	80,430
1926	1,540	608	2,148	18,580	14,758	33,338	42,540	75,535	118,075
1927	1,800	856	2,656	13,890	9,568	23,458	40,210	49,693	89,903
1928	620	762	1,382	13,310	5,474	18,784	45,230	57,007	102,237
1929		300	300	11,390	6,500	17,890	78,700	50,379	129,079

DOMESTIC INDUSTRY

California.—C. S. Maltby, operating mines in Santa Clara County, was again the largest producer in the State, producing both dead-burned and caustic calcined magnesite. The Sierra Magnesite Co., the second largest producer in the State, has undertaken production at a property in Stanislaus County about 20 miles west of Ingomar. Its calcining plant is at Porterville, Tulare County, where it produces both caustic calcined and a special grade of dead-burned magnesite, "periclase," in two kilns; its principal mine is in Tulare County at Magnesite, 12 miles east of Porterville. The California Magnesite Co. operated the Red Mountain mine in Stanislaus County, west of Patterson, and made sales of caustic calcined magnesite for magnesia heat insulation and for flooring and stucco. This mine was operated in 1927 and 1928 by the Red Mountain Magnesite Co., lessee. The Sampson Magnesite Co., which made its first shipments in 1928, continued the production of dead-burned material at its Sampson Peak mine in San Benito County; Mendota is the nearest railroad point. F. M. Nevins reported a considerable tonnage of magnesite extracted in development work at Parkfield in Monterey County, near Coalinga; no magnesite was sold, but roads were built so that shipments could be made in 1930. Other mines and prospects in the above-mentioned counties and in Alameda, Fresno, Placer, San Bernardino, Sonoma, and Tuolumne Counties reported no production in 1929. The Celite Co., recently acquired by Johns-Manville, purchased calcined magnesite from local producers for the manufacture of 85 per cent magnesia insulation.

Nevada.—H. E. Springer, Mina, Nev., produced and shipped a little more than 40 short tons of brucite (natural magnesium hydrate) from a large deposit discovered in 1927 on the west slope of the Paradise Mountains, in Nye County, and described in previous reports of this series.

Washington.—In 1929, as in former years, the Northwest Magnesite Co., operating the Finch mine, near Chewelah, Stevens County, was the only producer in the State of Washington. Two of its six kilns were operated almost continuously during 1929, and for a time two others were operated. The company produced and sold a small tonnage of caustic calcined magnesite in addition to its shipments of dead-burned material to an eastern refractory company. The erection of a plant near Spokane for producing magnesite lumber (heraklith) has been proposed; the plant is to utilize the waste from the magnesite quarries and wood shavings (similar to excelsior).

WORLD PRODUCTION

World production of magnesite, 1924–1928, by countries, in metric tons [1]

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country	1924	1925	1926	1927	1928
Australia:					
New South Wales	12,697	14,237	10,428	10,178	10,840
Queensland	151	271	-----	-----	-----
South Australia	131	357	230	335	46
Victoria	77	92	96	73	73
Austria	[2] 156,868	290,000	237,000	356,000	310,000
Canada	9,512	3,827	11,429	18,523	25,137
Cyprus [3]	224	-----	83	16	-----
Czechoslovakia [4]	60,044	69,532	83,135	84,563	87,396
Greece	66,727	90,828	95,638	84,484	104,421
India, British	24,854	30,095	30,950	19,953	24,798
Italy	13,436	14,146	19,842	16,304	11,690
Norway	1,976	1,699	715	1,090	932
Russia [5]	33,214	75,840	103,017	106,583	(6)
Union of South Africa	2,001	1,823	1,884	1,839	1,481
United States (sold or treated)	108,952	109,460	121,109	110,213	115,393
Yugoslavia [7]	-----	-----	-----	1,680	6,267

[1] Unless otherwise stated, the quantities in this table represent crude magnesite mined.

[2] Data relate to exports of crude and sintered magnesite, the sintered being reduced to crude on the basis of 2.1 tons of crude to 1 ton sintered. In addition, 6,431 tons of caustic magnesia was exported.

[3] Exports.

[4] Exports, less imports, of crude and sintered magnesite, the sintered being reduced to crude on the basis of 2.1 tons crude to 1 ton sintered.

[5] Year ended Sept. 30.

[6] Data not available.

[7] Serbia only.

FOREIGN INDUSTRY

A war-time estimate placed the magnesite reserves of the world (short tons) as follows: Austria-Hungary, 120,000,000 tons; Greece, 5,500,000 tons; Washington, United States, 7,000,000 tons; California, United States, 750,000 tons; and Venezuela, Margarita Island, 3,200,000 tons. Important resources are also available in Manchuria, Canada, Russia, British India, and various other parts of the world. Magnesite is not an uncommon mineral and it is mined on a commercial scale in more than a dozen countries. Supplies from most of these countries and from deposits still unworked could be largely increased, probably even at present prices, provided the demand increased correspondingly.

The principal European producers, including those situated in the former Austrian-Hungarian Empire, are associated in a cartel.

Australia.—Magnesite is mined for local consumption in three States in Australia, although one mine in New South Wales produces the greater part of the output—about 10,000 tons annually. In 1928 New South Wales produced a total of 10,840 metric tons, valued at $68,327; Victoria contributed 73 tons, valued at $1,153; and South Australia produced 46 tons, valued at $438.

Austria.[4]—Despite some falling off in the last quarter of the year, the Austrian output of raw and dead-burned magnesite in 1929 greatly exceeded that in 1928. After increasing substantially in 1927 and 1928 the output of caustic calcined magnesite declined 3,000 tons, or 8 per cent, in 1929. The total Austrian output of crude magnesite during 1929, including both crystalline and amorphous varieties, is estimated at 438,000 metric tons, an increase of 128,000 metric tons, or 41 per cent, as compared with 1928. Four companies contributed to this production, but two of them—Veitscher Magnesitwerke A. G. and the Oesterreichisch-Amerikanische Magnesit A. G., the latter an American-owned concern—contributed more than 92 per cent of the total. The two smaller companies—the Steirische Magnesitindustrie A. G. and the Alpenländische Bergbaugesellschaft, m. b. H.—mined only amorphous magnesite, which is not used for the manufacture of dead-burned magnesite. The output of dead-burned magnesite amounted to 135,500 metric tons, or 22 per cent more than in 1928. The output of magnesite brick (included in the tonnage of dead-burned magnesite) rose from 42,000 to 46,000 metric tons. Stocks increased toward the end of the year, but probably did not exceed three or four months' production. The producing companies were prosperous during the year. A new company, the Alpenminen A. G., was formed by American and Austrian investors; in addition to acquiring mining rights on several magnesite deposits, most of them small, in the western part of the Province of Salzburg and in the eastern part of Tyrol, the new concern owns lignite mines in Carinthia.

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[4] Harris, E. H., consul general, Vienna, Apr. 11, 1930.

In 1929 Austria exported 1,422 metric tons of crude magnesite and 27,466 tons of caustic calcined magnesite. Germany absorbed practically all the crude and 19,542 tons of the caustic calcined material; the remainder of the caustic calcined was shipped to various European countries and to a considerable number of more distant points all over the world. Of the 90,248 metric tons of dead-burned magnesite exported from Austria in 1929 the United States received a trifle more than 50 per cent. One-half of the remainder was destined for Great Britain and Germany, and the rest was scattered among more than a dozen smaller European consuming countries and a few more distant localities.

Prices were stable, $19.40 and $43.50 per metric ton being quoted for dead-burned grain magnesite and brick, respectively, for domestic retail business, and $25.50 and $44, respectively, c. i. f. United States Atlantic ports. The cartel agreements with regard to sales, quotas, and prices were continued without change.

At the end of August German steel interests obtained a large interest in the Veitscher Co. Now about 33⅓ per cent of the shares of this important concern are said to be owned by German interests, 25 per cent by a French steel company, 17 per cent by an Austrian bank; the remaining 25 per cent are held by various other concerns and individuals.

British India.—In 1928 the output of magnesite in India amounted to 24,798 metric tons, a considerable increase as compared with 1927 but substantially less than the high records established in 1925 and 1926. Most of the Indian output has come from the Chalk Hills at Salem, in the Madras Presidency, in South India, where high-grade deposits have been worked for 30 years. Recently an increasing quantity has been reported from the Mysore State, but in 1929 the output from the latter State dropped to 1,431 tons, only a trifle more than half the quantity produced in 1928. Some 150 tons of magnesite was mined at Tallur in 1929 but not sold.

Canada.—The production of "calcined or clinkered" magnesite in Canada, according to the Dominion Bureau of Statistics, was 18,701 short tons, valued at $491,170, in 1929, as compared with 13,195 tons, valued at $346,990, in 1928.

The Quebec deposits, in the Grenville and Harrington districts, about halfway between Montreal and Ottawa, are dolomitic in character. As the lime content is considered an undesirable impurity by both steel workers and flooring manufacturers, the deposits were not developed extensively until overseas supplies were cut off by the World War, when Canadian exports suddenly rose to a value of over a million dollars annually. After the Armistice the Quebec producers lost their newly acquired markets. In recent years active work has been carried on in the laboratories of the Dominion Department of Mines at Ottawa under the direction of the National Research Council. A patent has been taken out on a process for mechanically enriching the material; it was found that light crushing of the carefully calcined rock pulverized the softer magnesite so that the portion high in lime and silica could be largely removed by screening.

After a long series of calcining experiments, however, it was found that a suitable product could be made without removing the lime. It is claimed that this new dolomitic material is sufficiently refractory and that it is more quickly burned in than a magnesite bottom. Both Canadian and foreign patents have been applied for on this product, which is finding a sale in Canada and in the United States and England. Methods for producing a lightly calcined product suitable for use in Sorel cements had previously been worked out. The council's staff also undertook to develop a method of making bisulphite liquor for use in the production of sulphite wood pulp. Ordinary raw magnesite used for this purpose dissolved too slowly and also produced sludge that tended to choke the towers. Calcined material likewise was unsatisfactory owing to its lack of mechanical strength. The method recommended was to introduce the finely ground or slaked material with water into towers filled with coarse limestone. Research on the possibility of manufacturing refractory brick from the Canadian material is also said to have produced encouraging results. The laboratory work is being continued under a cooperative arrangement with the operating companies.[5]

Russia.—Before the war Russia imported considerable quantities of magnesite. The domestic production in 1913—60,617 metric tons—was insufficient to supply the requirements of the country. During recent years, however, production has expanded substantially, reaching nearly 120,000 tons in the fiscal year of 1927–28. Imports, amounting to 12,339 metric tons in 1913, dropped to 1 ton in the fiscal year ended September 30, 1929. In 1913 Russia exported no magnesite, but in 1928–29 exports had risen to 16,448 metric tons. In addition to the Satkin deposits in the Urals, which were worked before the war, the Khalilov deposits are now being worked. The average analysis of the Ural magnesite (calcined) is given as follows: MgO, 90–92 per cent; CaO, 3–4 per cent; SiO_2, 2–3½ per cent; $Fe_2O_3.Al_2O_3$, 4–5 per cent; loss on ignition, 0.5–1 per cent.

Yugoslavia (*Serbia*).—Magnesite is found throughout central Serbian Macedonia, mostly as small local occurrences of little economic value with the exception of those in a belt 1½ kilometers wide and 10 kilometers long following the valley of the Vardar River, about 25 kilometers south of Skoplie, a station on the Salonica-Belgrade Railway.

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[5] Chemical News (London), The Canadian Magnesite Industry: Vol. 140, Mar. 7, 1930, pp. 149–151.

DOLOMITE[6]

DOLOMITE PRODUCTS

The uses of dolomite as well as limestone for flux in blast furnaces and open-hearth steel furnaces and the use of dead-burned dolomite as a refractory furnace lining have been reviewed by Bowles.[7] Dolomite for open-hearth lining is usually precalcined, but when employed for patching on slag lines it is used raw.

The sales of dolomite for uses that may be considered competitive with magnesite have been segregated so far as possible by the Bureau of Mines for many years. The approximate quantity of crude dolomite used in the manufacture of such products has been as follows:

Crude dolomite sold by producers in the United States for certain uses, 1920–1929, in short tons

[Includes dead-burned dolomite, basic magnesium carbonate, sulphite process of paper manufacture, and making of carbon dioxide]

1920	1, 580, 000	1925	1, 425, 000
1921	499, 000	1926	1, 480, 000
1922	1, 074, 000	1927	1, 355, 000
1923	1, 226, 000	1928	1, 605, 000
1924	1, 239, 000	1929	1, 654, 000

DEAD-BURNED DOLOMITE

Dead-burned dolomite is used principally as refractory material. The quantity so used is many times that of dead-burned magnesite, and a comparison of the figures in the following table with those given on page 125 as representing the total new supply of dead-burned magnesite would indicate that the average consumption of dolomite refractories is increasing more rapidly than that of magnesite products. Some manufacturers of dead-burned dolomite buy their stone, the sales of which are reported by the quarry companies in terms of crude stone; others quarry their own stone and report only in terms of dead-burned material. The two kinds of material, as well as the estimated total output in terms of dead-burned dolomite, are represented in the following table:

Dead-burned dolomite sold or used by producers in the United States, 1920–1929

Year	Reported as raw stone		Reported as dead-burned		Total quantity calculated as dead-burned (short tons)
	Short tons	Value	Short tons	Value	
1920	612, 800	$742, 020	316, 293	$3, 732, 522	623, 000
1921	79, 480	85, 786	107, 664	1, 113, 010	147, 000
1922	146, 640	172, 251	348, 838	2, 813, 946	422, 200
1923	205, 890	249, 993	357, 642	3, 599, 116	460, 600
1924	309, 010	287, 137	328, 659	3, 209, 257	483, 200
1925	415, 710	375, 315	392, 145	3, 730, 509	600. 000
1926	511, 300	458, 802	386, 715	3, 593, 731	642, 000
1927	434, 160	424, 140	374, 415	3, 459, 803	591, 000
1928	522, 850	509, 502	448, 761	4, 283, 036	710, 000
1929	516, 400	461, 444	488, 032	4, 261, 942	746, 000

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[6] Figures on dolomite compiled by A. T. Coons, of the Bureau of Mines.

[7] Bowles, Oliver, Utilization Problems of Metallurgical Limestone and Dolomite: Am. Inst. Min. and Met. Eng., Tech. Pub. No. 62, Class C, Iron and Steel, No. 8; Class H, Nonmetallic Minerals, No. 1.

BASIC MAGNESIUM CARBONATE

Basic magnesium carbonate, or "technical carbonate," used in "85 per cent magnesia" pipe and boiler coverings is made in the Eastern States mainly from dolomite. Methods for producing this product from dolomite in a single cycle of operations were described in detail some years ago.[8]

The crude dolomite used for this purpose, whether purchased or quarried by the manufacturers, is reported annually to the Bureau of Mines. No figures on the output of the finished product are given. In addition to that made from dolomite, a quantity of technical carbonate is made in California from caustic calcined magnesite or natural magnesium salts.

Dolomite sold or used by producers in the United States for manufacture of basic magnesium carbonate, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	57,300	$107,107	1925	98,980	$131,440
1921	32,050	60,648	1926	72,850	110,560
1922	53,170	79,313	1927	69,940	115,932
1923	116,410	146,337	1928	94,200	122,260
1924	98,160	129,390	1929	84,750	129,383

HIGH-MAGNESIUM LIME FOR SULPHITE PAPER MILLS

An estimate of the high-magnesium lime sold to sulphite paper mills in the last 10 years is given below. Exact figures are impossible to obtain, as many lime producers who sell burned lime to paper mills do not specify the kind of paper mill. The quantity sold is expressed as burned lime.

High-magnesium lime sold by producers in the United States to sulphite paper mills, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	121,817	$1,347,321	1925	53,000	$451,000
1921	68,992	711,345	1926	52,600	482,000
1922	70,000	650,000	1927	50,000	441,000
1923	75,000	750,000	1928	46,000	359,000
1924	70,000	625,000	1929	51,000	398,000

CARBON DIOXIDE

Sales of crude dolomite for the manufacture of carbon dioxide in the last 10 years are as follows:

Dolomite sold by producers in the United States for the manufacture of carbon dioxide, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	33,040	$73,671	1925	19,740	$36,854
1921	34,090	124,984	1926	16,520	31,424
1922	38,280	58,748	1927	(a)	(a)
1923	38,460	52,494	1928	(a)	(a)
1924	34,600	57,105	1929	(a)	(a)

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[a] Bureau of Mines not at liberty to publish figures.

[8] Rock Products, Manufacture of 85 Per Cent Magnesia: Vol. 26, No. 4, Feb. 24, 1923, pp. 26–27.

MAGNESIUM

Year after year the magnesium industry has advanced by leaps and bounds, but in 1929 it made an even larger gain than in any previous year. The domestic output of virgin ingot increased from 521,075 pounds in 1928 to 1,329,669 pounds in 1929, or 155 per cent. An even greater increase is forecast for 1930, as magnesium has emerged definitely from the experimental stage and has become a commercial material of substantial importance. Price reductions of 5 to 20 cents a pound, which became effective in January, 1930, now place magnesium on a competitive basis with other light metals for airplane construction. Large-size ingots are sold for 65 cents to $1 a pound, according to quantity.

During 1928 and 1929 the entire domestic output of primary magnesium has been supplied by the Dow Chemical Co. from magnesium chloride recovered as a joint-product of its salt wells at Midland, Mich. The American Magnesium Corporation formerly produced the metal at Niagara Falls, N. Y., from selected caustic calcined magnesite, using a process similar to that employed in the manufacture of aluminum. In May, 1927, the American Magnesium Corporation ceased the manufacture of ingot magnesium by the oxide process and thenceforth has purchased its requirements from the Dow Chemical Co., confining its activities to the partial fabrication of the metal in the form of extruded bar, alloys, castings, forgings, sheet, wire, and powder. In July, 1928, the fabricating equipment was moved from Niagara Falls to the plant of the United States Aluminum Co., at Cleveland, Ohio, where these various forms are produced. The metal is produced in the form of 8 to 12 pound ingots 3 by 3 by 15 inches or in round sections 4 inches in diameter and 16 inches long. Smaller ingots or billets, mostly round bars from 12 to 27 inches long and from ½ inch to 1⅜ inches in diameter, are produced from the original ingots by remelting or extruding.

As the interest in magnesium is rapidly growing, numerous organizations are considering the production of various articles and machine parts from the metal or its alloys. In the early part of 1929 the Bohn Aluminum & Brass Corporation, of Detroit, Mich., began producing magnesium castings and fabricated parts under the trade name "Bohnalite X." Articles of incorporation of the United States Metallic Magnesium Co., capitalized at $1,000,000, were filed early in March, 1929; this company proposed to manufacture magnesium metal from a dolomite deposit controlled by the Little Flower Mining Co., near Logan, Utah. No production was reported by either company in 1929. The Elektron Metals Corporation of America, which formerly imported magnesium from Germany, suspended operations in 1924.

In former years an attempt was made to report statistics on the aggregate value of the products of the magnesium industry. This method of reporting the figures of production was feasible so long as the industry remained small and self-contained and the fabrication of the metal into rods, tubing, castings, powder, and other semifinished and finished forms was conducted almost exclusively in the same establishments in which the virgin ingot was produced. Even at the present time by far the bulk of the magnesium sold is marketed in the form of ingots However, the production of manufactured forms is increasing fairly rapidly, and as it is no longer confined to one or two integrated plants the time has come to adopt the usual procedure employed in reporting the output of other metals and to report the production of primary or virgin magnesium metal separately from the manufactured forms produced therefrom. Beginning with 1928, therefore, the production data are not strictly comparable with the figures for earlier years.

Sales of domestic ingots and manufactured forms from 1920 to 1927 and production and sales of domestic ingots in 1928 and 1929 are shown in the two following tables.

Domestic metallic magnesium (ingots, castings, alloys, ribbon, powder, rods, tubes, sheets, etc.) sold or used by producers in the United States, 1920–1927

Year	Pounds	Value	Year	Pounds	Value
1920	123, 800	$233, 200	1924	[1] 128, 000	[1] $150, 000
1921	48, 000	86, 000	1925	245, 000	274, 400
1922	[1] 60, 000	[1] 89, 000	1926	322, 650	390, 400
1923	[1] 125, 000	[1] 155, 000	1927	366, 400	441, 700

[1] Estimate.

New ingot magnesium produced and sold in the United States, 1928 and 1929

Year	Produced (pounds)	Sold or used by the producer	
		Pounds	Value
1928	521, 075	530, 782	$289, 658
1929	1, 329, 669	908, 351	512, 313

Much progress has been made in the development of extrusion, forging, and other fabrication methods, and as a result magnesium can now be obtained in practically all standard sizes of rods, angles, tubing, etc. Magnesium wire and ribbon are used largely in the radio-lamp trade for the degasification of radio tubes. Magnesium ribbon (extruded) is used in various heating appliances; the ribbon is wound around the article to be insulated and then subjected to superheated steam which converts the metallic ribbon into an insulating film of oxide. Sheet is employed largely in radio rectifiers. For sand castings a heat-treated alloy containing 7 per cent of aluminum and 0. 4 per cent of manganese is used in increasing quantities in connection with airplane construction, especially for engine castings; the physical properties of this alloy average 32,000 pounds per square inch tensile strength with 8 per cent elongation.

The sales of manufactured magnesium as reported by the leading producers for recent years are as follows:

Manufactured magnesium (other than ingot) sold by producers in the United States, 1926–1929, in pounds

Product	1926	1927	1928	1929
Alloys	6, 862	11, 835	16, 210	13, 145
Castings	36, 936	31, 992	55, 861	116, 350
Powder	31, 551	31, 658	27, 294	35, 943
Wire and ribbon	5, 662	4, 748	7, 695	7, 736
Rod and tubing [1]	614	1, 191	719	1, 864
Sheet	4, 198	10, 883	8, 425	8, 512
Shavings	72	42	810	720
Other	----------	21, 941	20, 218	12, 051
	85, 895	114, 290	137, 232	196, 321
Total value	$199, 684	$269, 403	$301, 346	$393, 916

[1] Exclusive of extruded rods or ingots sold for metallurgical purposes.

IMPORTS

In 1928 the imports of magnesium powder increased notably, but in 1929 the imports of magnesium under all categories dropped to the lowest point in many years; the total, 3,490 pounds, was the equivalent of only one-fourth of 1 per cent of the domestic production.

In the tariff act of 1930 no change was made in the duties imposed in 1922, the rates remaining at 40 cents a pound on metallic magnesium and scrap and 40 cents a pound on the magnesium content plus 20 per cent of the foreign market value on manufactured forms including alloys.

Magnesium imported for consumption in the United States, 1920–1929

Year	Pounds	Value
1920	29,275	$25,055
1921	39,913	30,592
1922	182,939	54,448
1923	13,974	11,576
1924	8,738	6,561
1925	8,326	$7,070
1926	10,117	4,750
1927	7,131	8,402
1928	12,039	11,890
1929	3,490	6,539

Magnesium imported for consumption in the United States, 1928 and 1929, by classes

Class	1928		1929	
	Pounds	Value	Pounds	Value
Alloys (magnesium content)	20	$57	52	$147
Magnesium, metallic and scrap	1,000	1,048		
Powder (magnesium content)	10,133	9,443	2,951	5,351
Sheets, tubing, ribbons, wire, and all other articles of magnesium	886	1,342	487	1,041
	12,039	11,890	3,490	6,539

DEVELOPMENT AND OUTLOOK

Considerable attention was given during the year to beryllium, a metal practically as hard as steel and even lighter than magnesium. At the present time, however, beryllium is available only in very small quantities, and the price is necessarily far too high to make it available for structural purposes. Nominally it sells for $200 a pound, and although the price will undoubtedly be greatly reduced there is no apparent prospect of producing the metal, at least for many years, at a cost of less than about $15 a pound. As an alloying agent beryllium has much promise, but apparently it is not likely to offer any serious competition to magnesium. A fundamental difficulty is the absence of known supplies of high-grade ore of sufficient size to sustain production on a large scale. Beryl, the one beryllium mineral of commercial significance, does not occur in substantial quantity in many localities and seldom contains more than about 5 per cent of the element even when completely free from mechanically associated impurities. Magnesium, on the other hand, is not only cheap and abundant in nature but also occurs in relatively concentrated conditions.

Price has likewise been a deterrent to more rapid development of the magnesium industry, especially in the United States. As production grows, however, manufacturing costs are being progressively reduced, and as costs and prices are reduced the field for the metal is correspondingly increased. The matter of comparative cost relates not only to the cost of the ingot metal but also to its subsequent treatment. The following pertinent remarks are abstracted from a statement by the president of the American Magnesium Corporation:[9]

> The best heat-treated aluminum alloys in sheet or forgings will have 60,000 to 63,000 pound tensile strength with 18–25 per cent elongation. The best average result possible with magnesium-base alloys is about 42,000 tensile with 10 per cent elongation. The difference in weight is as 1.74 to 2.70, or a saving of about 33⅓ per cent. This saving in weight for equal sections is practically balanced by the difference in strength. * * *
>
> With castings the comparison is slightly better. Heat-treated magnesium castings are about on a parity as to strength and elongation with the average heat-treated aluminum castings. Eliminating the lower proportional limit due to the different moduli of elasticity, a field for magnesium castings exists in aircraft motors and accessories, where weight saving is so essential. This field has been vigorously tilled, with the trebling of consumption in a year, but this means a rate of only 15 to 20 tons annually.
>
> Commercial, and not technical, conditions are the limiting factor. * * * Losses in melting are greater than with aluminum, and in subsequent fabricating operations cold work hardens magnesium much more rapidly, making more frequent annealing necessary. The lightness of the metal requires more and larger gates and risers in casting, which again is translated into additional costs.
>
> Still more important are the different conditions abroad. With automotive vehicles, taxes and high cost of gas and oil put a premium on lightness. In Germany magnesium-alloy wheels have been extensively used on trucks. The castings sell in quantity at 80 cents per pound. Corresponding aluminum castings sell for 35 to 40 cents per pound. Allowing for the difference in weight of one-third, magnesium castings are purchased at substantially a premium of 25 cents per pound. In the United States does "evolution demand" that our truck manufacturers pay such an increase? It would be satisfactory to the magnesium industry if it did, but the attempt to sell the product on this basis would be disappointing.
>
> In France forged or hot-pressed pistons of pure magnesium have been largely sold for Government aircraft motor development at a considerably higher price than the corresponding aluminum. With the highly developed aluminum piston art in this country, it has been difficult to show any advantage with the lighter metal, because of the greater expansion, smaller heat conductivity, and inferior hardness. One manufacturer has spent a fair fraction of a million dollars in the attempt to market magnesium pistons in the automotive field without tangible return.
>
> The truth is that magnesium will ultimately find its place in the broad economic picture, but only through further patient and expensive research and development. Its natural market will lie in lines where peculiar properties will demand its use and not in directions where forced growth is essential and where some other broadly competitive material is commercially indicated. Unwise attempts to "stimulate" its consumption are bound to result in ultimate failure. It has taken 30 years of gradual progress to develop aluminum to a point where railroad car bodies are in sight, and yet 30 years ago enthusiasts were seeing the immediate use of the then soft and relatively weak metal in the replacement of steel. Aluminum has only a third of the weight of any of the common metals. Magnesium is two-thirds the weight of its natural competitor in the metal group and much more difficult to fabricate. The "infant industry" is still an infant, and it needs intelligent care and sympathetic understanding.

In Europe magnesium is used much more extensively than it is in the United States. Germany is unofficially reported as producing about 2,000 tons a year, chiefly in the form of the various "elektron" alloys manufactured by the I. G. Farbenindustrie, A. G. A new factory in Switzerland is expected to produce 300 tons in 1930 and mention is made of a proposed plant in Venice, Italy. Probably more than 75 per cent of the magnesium used in the United States is used as a deoxidizer and desulphurizer or as a minor addition in aluminum heat-treated alloys, but in Europe the conditions are reversed and probably about 80 per cent of the consumption is in fabricated shapes or alloys. In Germany, particularly, magnesium is extensively used not only in aircraft but in automobile busses and trucks. In the United States aircraft absorbs most of the production of fabricated shapes.

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[9] Colby, S. K., Aluminum vs. Magnesium: Eng. and Min. Jour., vol. 127, June 1, 1929, pp.

A table presented by Jeffries [10] shows various alloys ranging in tensile strength from a minimum of 22,000 up to a maximum of 57,000 pounds per square inch and in hardness from 40 to 87 Brinell. Elongations up to 16 per cent are listed. Young's modulus of elasticity (E) is given as about 6,250,000 for the commercial alloys.

The microstructure of magnesium-manganese alloys has been studied by Pearson,[11] who concludes that the solid solution area extends beyond 2.7 per cent Mn. In higher ranges the manganese may show up as angular masses, forming, in the case of alloys containing 35 per cent or more Mn, irregular masses in a background of magnesium.

Investigating lead-magnesium alloys, Ackermann [12] found no advantages as compared with the low tin-lead or tin-lead-antimony bearing metals which are cheaper and easier to machine. Magnesium-zinc alloys have also been studied recently in Germany.[13]

A method for refining magnesium (produced electrolytically from the chloride) by means of "Elrasal" (a mixture of alkaline earth chlorides, fluorides, and magnesium oxide) has been described by Vogel,[14] and the preparation of 99.99 magnesium by sublimation is described by Bakken.[15]

MAGNESIUM SALTS

The production of magnesium salts, largely magnesium sulphate and chloride, from natural salt and bittern waters in the United States in 1929 was 90,425,360 pounds, valued at $1,081,817, compared with 70,909,805 pounds, valued at $1,020,044, in 1928. There were less than three producers each of magnesium sulphate and magnesium chloride and the Bureau of Mines is not at liberty to publish production figures separately.

Magnesium sulphate was produced in the United States in 1929 by the Dow Chemical Co., Midland, Mich., by treatment of the natural chloride, as later described. Extensive deposits of epsomite in Okanogan County, Wash., owned by the Magnesia Products Co., have not been operated for several years. Commercial magnesium chloride (flake) containing 97 per cent $MgCl_2.6H_2O$ is made by the Dow Chemical Co. and also by the California Chemical Corporation. The California Chemical Corporation also reported sales of partially processed liquors, which were sold on the magnesium content basis and further manufactured into basic magnesium carbonate. This corporation, which is affiliated with the National Kellastone Co. of

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[10] Jeffries, Zay, Light Alloys: Metals and Alloys, vol. 1, December, 1929, pp. 270–271.

[11] Pearson, G. W., Magnesium-Manganese-Alloys: Ind. and Eng. Chem., vol. 22, April, 1930, pp. 367–370.

[12] Ackermann, C. L., Untersuchungen an Blei-Magnesium Legierungen: Metallwirtschaft, July 19, 1929, pp. 701–702.

[13] Grube, G., and Burkhardt, A., Die elektrische Leitfaehigkeit, die thermische Ausdehnung und die Haerte der Magnesium-Zinc-Legierungen: Ztschr. Elektrochem. u. angew. physical. chem., June, 1929, pp. 315–332.

[14] Vogel, F., Die Reinigung des Magnesiums: Metallboerse, Feb. 27, 1929, pp. 453–455.

[15] Bakken, H. E., High Purity Magnesium Produced by Sublimation: Chem. and Met. Eng., vol. 36, June, 1929, pp. 345–347.

Chicago, has a plant at Chula Vista, San Diego County, Calif., where magnesium chloride and bromine are produced. They also have a bromine plant in San Mateo County and own the Industrial Chemical Corporation, which formerly had a plant at the Arden Salt Works, near Arden Hills. The latter plant produced various salts from bittern waters, but it has been dismantled and a new one is being erected at Newark for treating the bitterns from the Arden Salt Co. and Leslie-California Salt Co. for the production of bromine, magnesium chloride, and hydrochloric acid. The bromine will be converted into bromides. The bitterns from the Arden Salt Co. will come to the new plant through a pipe line 1 mile long, whereas the Leslie-California plant pipe is 7 miles long. The company expects to be in active production of bromine, magnesium chloride, and magnesia in 1930.

The Marine Chemicals (Inc.), South San Francisco, Calif., in 1929 again produced magnesium carbonate by a patented process from ocean water.

An interesting development in the magnesium salts industry is the commercial production of Epsom salts from magnesium hydroxide, a by-product of the chain of processes devised for utilizing the complex contents of the salt brines of Midland, Mich. The process finally adopted has been recently described by the president of the Dow Chemical Co. [16]

> Sulphur dioxide gas is absorbed in magnesium hydroxide to form magnesium sulphite or magnesium acid sulphite. This mixture is then oxidized to sulphate by blowing with air. We found that the acidity or alkalinity—or in other words, the hydrogen-ion concentration—of the magnesium sulphite solution was of utmost importance in carrying out the oxidation. It is well known that the oxidations of salts of lime, magnesium, iron, manganese, etc., are most easily attained in an alkaline medium, as in the reoxidation of manganese salts in the Weldon process. In the present case, however, although an alkaline condition would be desirable for effecting the oxidation, the magnesium sulphite unfortunately is almost insoluble in an alkaline solution and consequently would escape oxidation at a satisfactory rate when the suspension was blown with air. On the other hand, magnesium acid sulphite is readily soluble, but the acidity of the solution retards and may even stop the oxidation completely. In this dilemma we were finally led to a solution of the problem by the discovery that a mixture of normal sulphite and acid sulphite within a narrow range of composition could be oxidized at a sufficiently rapid rate to make the process commercially feasible. It was important, however, to maintain the composition of mixture within the prescribed limits, if the oxidation were to be effected successfully.
>
> At this point the question arose—how to maintain the correct ratio of normal sulphite to bisulphite when the proportions were constantly changing as the oxidation proceeded. Chemical analysis and control were hopeless. In the first place, the mixture was of a muddy consistency, hard to filter, and incapable of showing a good end point with any known indicator. Then, again, if a suitable indicator could have been found which would have made possible a sufficiently accurate titration, the usual methods of chemical analysis would have been too slow. Before the results could have been obtained, the composition of the mixture would have changed materially. However, the optimum ratio of normal sulphite to acid sulphite corresponds to a certain definite acidity of the solution—that is, to a definite hydrogen-ion concentration. By devising an instrument which would record almost instantaneously the hydrogen-ion concentration of the mixture in the oxidation tank, it became possible to follow the progress of the reaction closely and to maintain the correct hydrogen-ion concentration by suitable additions of magnesium hydroxide. Although the development of a satisfactory recorder required more time than was anticipated, the object was successfully accomplished. Now it has been so far improved that the recorder

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[16] Dow, Herbert N., Economic Trend in the Chemical Industry: Ind. and Eng. Chem. vol. 22 February, 1930, pp. 113–116.

is caused to actuate a motor-operated valve which controls the feed of magnesium hydroxide added to the liquor. The whole operation of controlling the progress of the oxidation and the proper additions of hydroxide to maintain the correct acidity is carried out automatically. When the batch is finished, requiring about eight hours, a workman opens a valve to empty the tank and then refills with fresh mixture to start the next batch. At other times no operating labor is required except for occasional inspection. The automatic recorder functions accurately and without sleeping. It is not going too far to say that this process would have been a failure but for the creation of automatic recording and control means, which have proved to be indispensable for maintaining the uniform conditions required for successful operation.

Each one of the four vital factors in labor saving in a chemical plant is well exemplified in the Epsom salt process. We use equipment of such size that it can run for an 8-hour period before dumping the batch. The analysis of the batch is automatically recorded continuously, presenting on a chart clear history of the progress of the reaction. The automatic analyzer is employed to actuate valves to control the flow of materials added to the batch. Finally the complete cycle of the process is carried out continuously and automatically without manual operation of any kind except to open a valve to dump the finished batch. In fact, it would no doubt require the exercise of but a little more ingenuity to contrive means to control the valves for emptying and refilling the tank, thus dispensing entirely with manual labor or operation. Perhaps we will come to that, but we are still old-fashioned enough to believe that a process should have some one to look after it, at least once in every eight hours.

In 1923, 121 short tons of refined magnesium sulphate was shipped from a deposit near Ashcroft, British Columbia, but no natural magnesium salts have been produced in Canada since that year. Germany is the principal foreign source of supply. The annual production of magnesium chloride is about 35,000 tons of solid salt and about 60,000 tons of liquor, having an aggregate value of 3,700,000 marks; that of magnesium sulphate ("bitter salts") is 150,000 tons, having a value of some 4,500,000 marks. These salts are by-products of potash manufacture, and the syndicates controlling the output have recently been restored and combined with I. G. der deutschen Kali-Industrie G. m. b. H. British India is another large producer of magnesium salts.

The tariff act of 1930 (par. 49) makes certain changes in the classification of magnesium chemical compounds. A specific provision is added for manufactures of carbonate of magnesia at 2 cents a pound, and the duty on sulphate or Epsom salts is increased from ½ cent a pound to ¾ cent, and that on oxide or calcined magnesia is advanced from 3½ to 7 cents a pound.

Magnesium chloride imported for consumption in the United States, 1920–1929

Year	Anhydrous		Total	
	Pounds	Value	Pounds	Value
1920	(1)	(1)	454, 334	$7, 098
1921	(1)	(1)	7, 365, 812	85, 727
1922	(1)	(1)	11, 403, 837	113, 618
1923	56, 110	$2, 703	23, 052, 385	190, 748
1924	136, 082	1, 820	15, 200, 433	85, 206
1925	------	------	15, 922, 254	105, 462
1926	------	------	16, 093, 867	110, 477
1927	44, 374	315	8, 185, 363	59, 950
1928	427, 114	3, 125	5, 799, 750	41, 712
1929	------	------	3, 291, 856	23, 120

[1] Not separately recorded.

Magnesium sulphate (Epsom salts) imported for consumption in the United States, 1920–1929

Year	Pounds	Value	Year	Pounds	Value
1920	1, 803, 769	$66, 944	1925	8, 211, 228	$50, 466
1921	12, 519, 778	88, 153	1926	10, 600, 582	61, 018
1922	25, 390, 734	200, 203	1927	11, 620, 675	60, 527
1923	14, 455, 920	71, 566	1928	10, 459, 596	61, 600
1924	8, 881, 181	57, 579	1929	13, 541, 189	82, 416

Magnesium compounds imported for consumption in the United States, 1920–1929

Year	Calcined magnesia		Carbonate, precipitated		Year	Calcined magnesia		Carbonate, precipitated	
	Pounds	Value	Pounds	Value		Pounds	Value	Pounds	Value
1920	26, 859	$9, 093	14, 930	$1, 512	1925	162, 790	$43, 356	190, 413	$13, 004
1921	35, 182	7, 593	18, 514	2, 061	1926	520, 394	51, 454	241, 293	16, 142
1922	96, 792	15, 969	36, 254	3, 385	1927	259, 357	48, 093	348, 383	20, 115
1923	141, 375	30, 802	1, 046, 990	55, 137	1928	300, 897	60, 325	283, 264	17, 512
1924	101, 998	29, 252	481, 439	25, 333	1929	471, 545	83, 866	517, 414	29, 902

POTASH[1]

By A. T. Coons

PRODUCTION AND SALES

Potassium salts produced in the United States in 1929 contained the equivalent of 61,590 short tons of potash (K_2O), the largest quantity yet recorded and an increase of 3 per cent over 1928. The average content calculated as potash (K_2O) in the salts produced was 57.1 per cent in 1929, as compared with 57.5 per cent in 1928.

Total production of potassium salts in 1929 was 107,820 short tons—3.5 per cent more than in 1928. Sales of potassium salts, however, were 3.6 per cent less and the potash equivalent of the material sold nearly 5 per cent less than in 1928. The total value of the potassium salts sold was 1 per cent less than in 1928; the value per unit (20 pounds of K_2O) was 52 cents in 1929, as compared with 50 cents in 1928. For the first time since 1924 the sales were less than the production.

The stocks of salts remaining in producers' hands at the end of 1929 were about double those at the end of 1928, and their equivalent as potash (K_2O) was nearly three times that in 1928. Four plants less reported production in 1929 than in 1928, one less reported sales, and two less reported stocks remaining on hand.

Tables of sales by States and by sources are omitted to avoid disclosing individual production. A summary of production, sales, and producers' stocks of potassium salts in the United States for the past 10 years is given in the following table:

Potassium salts produced, sold, and in stock in the United States, 1920–1929

Year	Production			Sales				Stocks		
	Number of plants	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Number of plants	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Value f. o. b. plant	Number of plants	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)
1920	66	166,834	48,077	64	139,963	41,444	$7,463,026	38	32,378	8,999
1921	20	25,485	10,171	23	10,337	4,408	447,859	30	32,925	12,625
1922	12	25,176	11,714	16	22,028	11,313	463,512	16	30,100	11,653
1923	12	39,029	20,215	11	35,164	19,281	784,671	14	34,794	12,363
1924	12	43,734	22,903	9	37,492	21,880	842,618	11	32,389	10,770
1925	9	51,565	25,448	7	52,823	25,802	1,204,024	7	[a] 30,919	10,276
1926	7	46,324	23,366	6	51,369	25,060	1,083,064	4	[b] 26,000	[b] 9,000
1927	9	76,819	43,510	5	94,722	49,500	2,448,146	8	7,250	2,500
1928	9	104,129	59,910	5	105,208	60,370	3,029,422	7	6,260	2,100
1929	5	107,820	61,590	4	101,370	57,540	2,988,448	5	12,650	6,200

[a] Of this quantity 212 tons was lost by leaching, etc.

[b] Estimate.

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[1] Work on manuscript completed September, 1930.

PRODUCING LOCALITIES

In 1929 the potassium salts produced were from natural brines, from flue dusts of blast furnaces, and from the waste from molasses distillation. A small amount of alunite was utilized for experimental work. The American Potash & Chemical Corporation, 233 Broadway, New York, N. Y., the chief American producer of potassium salts, also recovered borax and other natural sodium salts as by-products from its plant at Trona (Searles Lake), San Bernardino County, Calif. Its output of potassium salts increased nearly 2 per cent in 1929, and somewhat less was marketed than was produced. The product sold by this company has a higher equivalent of potash (K_2O) than that of any other company, and the per cent in 1929 (61.29) was lower than in 1928 (61.48). The plant of the United States Industrial Chemical Co. (address, 110 East Forty-second Street, New York, N. Y.), at Baltimore, Md., was the second largest producer of potassium salts in 1929. The salts averaged 34.2 per cent K_2O, were mixtures of sulphates, chlorides, and small amounts of carbonates, and were recovered from the waste from molasses distillation. The company's sales in 1929 were slightly more than its production. Potassium salts (chiefly sulphates), from flue dusts of blast furnaces, were produced at the Reusens (Va.) furnace of the Lavino Furnace Co. (Philadelphia, Pa.). Some alunite, used chiefly for experimental work in connection with the use of alunite as a fertilizer, was shipped from Marysvale, Utah; the principal shippers were the Al-Ke-Mee Fertilizer & Manufacturing Co. (Inc.) and the Marysvale Cash Store, both of Marysvale. The Holland-St. Louis Sugar Co., Holland, Mich., sold potassium salts (in the form of concentrated Steffen's waste water) from its plant at Decatur, Ind., but it produced no new material.

The results of investigations of potash deposits in Texas, New Mexico, and other potash-bearing localities, as carried on by the Bureau of Mines, the Geological Survey, and other Government bureaus, are issued in separate publications and are not reviewed here.

IMPORTS AND EXPORTS[2]

Imports of potash materials are shown in the following tables. The materials are classified as salts used chiefly in the fertilizer industry and as those used chiefly in the chemical industries. The former class, which includes kainite, manure salts, muriate, and sulphate, accounted for nearly 92 per cent of the total potash (K_2O) imports in 1929.

The potash (K_2O) equivalents of the different salts in 1929 are calculated on the same estimated percentages as were used for 1928.

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[2] Figures on quantity and value of imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Potash materials imported for consumption in the United States, 1928 and 1929

Material	Approximate equivalent as potash (K_2O) (per cent)	1928				1929			
		Short tons	Approximate equivalent as potash (K_2O)		Value	Short tons	Approximate equivalent as potash (K_2O)		Value
			Short tons	Per cent of total			Short tons	Per cent of total	
Used chiefly in fertilizers:									
Kainite	14.0	119,897	17,000	5.1	$886,706	85,042	12,000	3.7	$643,950
Manure salts	24.0	453,242	109,000	33.0	5,251,200	437,727	105,000	32.3	5,113,085
Muriate (chloride)	52.0	261,644	136,000	41.2	8,181,703	258,682	135,000	41.6	8,224,661
Sulphate	50.0	96,833	48,000	14.5	3,908,221	89,051	45,000	13.9	3,647,839
		931,616	310,000	93.8	18,227,830	870,502	297,000	91.5	17,629,535
Used chiefly in chemical industries:									
Bicarbonate	46.0	181	83	6.2	19,935	340	156	8.5	36,987
Bitartrate (argols)	20.0	6,445	1,289		1,330,645	8,843	1,769		2,077,763
Bitartrate (cream of tartar)	25.0	68	17		26,824	83	21		26,435
Bromide	39.6	12	5		7,918	14	6		9,834
Carbonate, crude	61.0	8,456	5,158		768,829	11,322	6,906		1,024,106
Carbonate, crude or black salts	50.0								
Carbonate, refined	67.0								
Caustic	80.0	5,824	4,659		686,479	7,821	6,257		1,000,249
Chlorate and perchlorate	36.0	6,290	2,264		461,161	6,808	2,451		484,576
Chromate and bichromate	40.0	3	1		1,112	4	2		1,537
Cyanide	70.0	58	41		43,590	68	48		54,204
Ferricyanide (red prussiate)	42.0	59	25		32,984	78	33		40,992
Ferrocyanide (yellow prussiate)	44.0	67	29		16,846	57	25		14,389
Iodide	28.0	(1)	(1)		16	[2] 1	(2)		5,181
Nitrate (saltpeter), crude	40.0	10,835	4,334		376,405	14,336	5,734		545,576
Nitrate (saltpeter), refined	46.0	5,305	2,440		416,052	9,036	4,157		687,130
Permanganate	29.0	300	87		54,259	17	5		3,162
Rochelle salt	22.0	39	9		10,165	6	1		2,072
All other	50.0	103	52		38,942	134	67		28,913
		44,045	20,493	6.2	4,292,162	58,968	27,638	8.5	6,043,106
Grand total		975,661	330,493	100.0	22,519,992	929,470	324,638	100.0	23,672,641

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[1] Quantity of iodide imported was 4 pounds.
[2] Quantity of iodide imported was 1,262 pounds; approximate equivalent as K_2O is 353 pounds.

In 1913, when the entire supply was imported, the United States imported the equivalent of 272,457 short tons of potash (K_2O); in 1929 the imports were 324,638 tons, or 19 per cent more than in 1913. The years 1928 and 1929, however, are the only ones during this period in which the imports of 1913 have been exceeded. The imports in 1929 were slightly more than 5 times the production in the United States in that year. The combined imports and domestic production in both 1928 and 1929 were 1.4 times the imports in 1913.

Approximate equivalent as potash (K_2O) of potash-bearing materials imported for consumption in the United States, 1920–1929, in short tons

1920	224,792	1925	258,217
1921	78,698	1926	266,280
1922	201,415	1927	244,155
1923	209,950	1928	330,493
1924	200,365	1929	324,638

The following table indicates the amount of potash-bearing materials imported in 1929 and the countries from which last shipment was made. Virtually all of the crude salts and much the larger part of the refined salts imported originated in Germany and France.

Potash materials imported into the United States in 1929, in short tons

[General imports. The figures in parentheses in the column headings indicate in per cent the approximate equivalent as potash (K_2O)]

Country	Muriate (chloride) (52)	Sulphate (50)	Manure salts (24)	Kainite (14)	Bitartrate		Caustic (80)	Carbonate (61)	Cyanide (70)	Nitrate (saltpeter) crude (40)	Chlorate and perchlorate (36)	All other (50)	Total	
					Argols or wine lees (20)	Cream of tartar (25)							Short tons	Value
Africa:														
Algeria and Tunisia					576								576	$139,032
Union of South Africa					12								12	3,271
Argentina					287								287	72,078
Austria												11	11	5,340
Belgium	84,017	12,130	168,867	27,468			(1)		1		45	4	292,532	5,283,047
Canada	540	8			1					2			551	20,363
Chile					206					13,271			13,477	523,214
China								1					1	132
Czechoslovakia								40					40	3,718
France					3,987	60	7,534		(1)	197	183	21	11,982	1,081,506
Germany	151,127	76,556	260,689	54,700				9,879	68	866	6,499	9,547	569,931	14,637,668
Greece					55								55	10,527
Hong Kong								1					1	343
Italy					1,851	14							1,865	392,645
Morocco					16								16	3,615
Netherlands	1,402	357	8,171	2,874	6		179	936				80	14,005	294,236
Portugal					967								967	210,010
Soviet Russia in Europe								453					453	44,384
Spain	21,596				1,036								22,632	901,080
Sweden							111				101		212	46,268
Switzerland											150	1	151	23,144
United Kingdom						17		12				32	61	24,035
	258,682	89,051	437,727	85,042	9,000	91	7,824	11,322	69	14,336	6,978	9,696	929,818	23,719,656
Approximate equivalent as potash (K_2O)	135,000	45,000	105,000	12,000	1,800	23	6,259	6,906	48	5,734	2,512	4,848	325,130	

[1] Less than 1 ton.

Potassium salts exported from the United States, 1922–1929

Year	Short tons	Value	Year	Short tons	Value
1922	6,238	$780,996	1926	1,679	$319,201
1923	3,997	505,837	1927	1,965	487,726
1924	1,923	301,036	1928	2,619	609,018
1925	2,155	398,740	1929	1,523	583,668

CONSUMPTION

The consumption of potash in the United States in 1929, as indicated by imports plus sales of domestic products (exports being negligible), was 1,030,840 short tons of material equivalent to approximately 382,178 tons of K_2O—a decrease of 2 per cent in quantity of K_2O compared with 1928. Of the totals in 1929, 10 per cent of the material containing 15 per cent of the K_2O was produced in this country. About 93 per cent of the total supply of potash (K_2O) was used in the manufacture of fertilizers.

MARKET CONDITIONS

Market conditions showed little change from those of the preceding year. As cotton, tobacco, and "truck" are the chief potash-consuming crops, the States east of Mississippi River and south of Ohio River and the Mason and Dixon line are the chief users of potash, although in the Northeastern States potash is used for growing potatoes and other vegetables. The prices at which foreign potash has been available have continued to curb American production and particularly to discourage the launching of new enterprises.

PRICES

The prices on foreign potassium salts which had remained unchanged since December 1, 1926, were increased May 1, 1929, in accordance with an announcement by the American sales agent for the French and German potash syndicates. Advances in prices for all grades of salts were made in amounts ranging from 10 to 45 cents a short ton and were guaranteed against reduction in continental United States until April 30, 1930. The prices prevailing at the end of the years 1925 to 1929 are given in the following table:

Prices of different grades of potassium salts at end of year, 1925–1929

[Per ton of 2,000 pounds, c. i. f. Atlantic and Gulf ports]

		1925	Dec. 31, 1926, to Apr. 30, 1929	May 1, 1929, to Dec. 31, 1929
Sulphate, 90 to 95 per cent	in bags	$45.85	$47.30	$47.75
	in bulk	44.60	45.70	46.15
Muriate, 80 to 85 per cent	in bags	34.90	36.40	36.75
	in bulk	33.65	34.80	35.15
Potash-magnesia sulphate (double manure salts), 48 per cent.	in bags	26.35	27.25	27.50
	in bulk	25.10	25.65	25.90
Manure salts, 30 per cent	in bags	20.00	21.75	21.95
	in bulk	18.00	18.75	18.95
Manure salts, 20 per cent	in bags	13.35	15.40	15.50
	in bulk	11.35	12.40	12.50
Kainite, 14 to 16 per cent	in bags	10.50	12.50	12.60
	in bulk	8.50	9.50	9.60
Kainite, 12.4 per cent	in bags	10.00	12.00	12.10
	in bulk	8.00	9.00	9.10

The discounts that applied until May 1, 1929, were given in the report of this series for 1928. According to the Oil, Paint and Drug Reporter, the following discounts were offered beginning May 1, 1929: On orders placed prior to June 1 for prompt shipment, 9 per cent; prior to June 1 for shipment in equal monthly quantities June to September, inclusive, 8 per cent; July 1 for July shipment, 7 per cent; August 1 for August shipment, 6 per cent; September 1 for September shipment, 5 per cent; October 1 for October shipment, 4 per cent; November 1 for November shipment, 3 per cent; December 1 for December shipment, 2 per cent. Bagged salts are sold on foreign weights, tares, and analyses and bulk salts on American weights and foreign analyses.

SUMMARY OF WORLD PRODUCTION

The following table, compiled by L. M. Jones, of the Bureau of Mines, lists the countries that in the last five years have produced potassium salts, and gives the available figures for their production of crude salts and K_2O equivalent. The list of countries differs somewhat from that given in the table of imports, because in that table some of the countries from which the imports came were not themselves producers but received their supply from other countries. Both tables, however, clearly show the predominance of Germany and Alsace as producers of potash.

World production of potash minerals and equivalent K_2O, 1925–1929, in metric tons

Country and mineral [1]	1925		1926		1927		1928		1929	
	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O
Australia: New South Wales, alunite	540	45	589	51						
Chile, perchlorate of potash [2]	86	(3)	121	(3)	101	(3)	297	(3)	(3)	(3)
China [4]	336	134	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Ethiopia, crude salts			1,635	(3)	1,600	800	1,300	650	(3)	(3)
France (Alsace), crude salts	1,926,346	[5] 311,892	2,316,546	[5] 366,670	2,321,775	[5] 372,260	2,580,196	[5] 410,635	3,124,816	[5] 493,934
Germany, crude salts:										
Carnallite [6]	2,831,658	268,618	1,867,129	181,917	1,773,195	171,208	2,057,760	200,488	(3)	(3)
Kainite, sylvinite, and hartsalz	9,197,918	1,306,221	7,540,980	1,080,672	9,298,346	1,346,829	10,431,310	1,490,640	(3)	(3)
India (British), nitrate of potash [7]	7,300	3,000	5,800	2,000	6,900	3,000	4,800	2,000	(3)	(3)
Italy:										
Alunite	1,500	170	1,600	180	800	90	195	20	210	22
Leucite rock	226,000	18,000	35,000	2,800	29,000	2,300	39,200	3,200	(3)	(3)
Japan, alunite	113	13	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Poland:										
Kainite	62,823	6,282	79,166	7,917	127,772	12,772	146,692	14,669	137,858	14,062
Sylvinite	115,980	31,315	128,523	31,025	148,340	31,053	194,964	40,942	220,770	49,673
Russia: [8]										
Alum stone	1,042	(3)	647	(3)	1,364	(3)	(3)	(3)	(3)	(3)
Alunite clays	1,125	(3)	3,305	(3)	3,065	(3)	5,500	(3)	(3)	(3)
Carbonate of potash [9]	3,967	(3)	3,136	(3)	3,784	(3)	(3)	(3)	(3)	(3)
Spain:										
Crude salts	27,734	4,021	80,598	11,687	172,356	17,236	243,233	24,323	243,994	(3)
Potassic earth	1,000	29	950	(3)	950	(3)	850	(3)	850	(3)
United States, crude salts	46,779	23,086	42,024	21,197	69,689	39,471	94,464	54,349	97,812	55,873

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[1] In addition to the countries listed, Queensland produced 6 tons of alunite in 1927, but working expenses equaled returns and operations were discontinued.

[2] Produced at nitrate plants from caliche.

[3] Data not available.

[4] Exports.

[5] Figures relate to merchantable products.

[6] Includes some natural kieserite.

[7] Estimated production (Imperial Institute, London).

[8] Year ended Sept. 30.

[9] Made from sunflower ash. The deposits of Solikamsk not on a producing basis during the period under discussion.

SALT, BROMINE, AND CALCIUM CHLORIDE[1]

By A. T. Coons[2]

SALT

PRODUCTION

Salt produced for sale or use by operators of salt mines, wells, and ponds in the United States in 1929 amounted to 8,543,560 short tons, valued at $27,334,695—an increase of 6 per cent in quantity and 2 per cent in value over the output in 1928. The output of evaporated salt in 1929—2,546,390 tons, valued at $17,921,922—represented 30 per cent of the total quantity of salt produced, and was an increase of 5 per cent in quantity and of less than 1 per cent in value compared with 1928. The salt content (3,884,160 tons) of the brine produced and used by producers in the manufacture of chemicals represented 45 per cent of the total salt produced, and was an increase of 13 per cent in quantity. Rock salt produced—2,113,010 tons, valued at $7,127,681—represented 25 per cent of the total output, and was a decrease of 5 per cent in quantity but an increase of 3 per cent in value. The average value of all salt was $3.20 a short ton in 1929—12 cents less than in 1928; that of evaporated salt, including pressed blocks from evaporated salt, was $7.04—29 cents less than in 1928; and that of rock salt, $3.37—25 cents more than in 1928.

Seventy-eight plants reported operations in 1929 as compared with 84 in 1928 and 104 in 1920.

Salt sold or used by producers in the United States, 1920–1929

Year	Short tons				Value[1]	
	Manufactured (evaporated)	In brine	Rock salt	Total	Total	Average
1920	2, 409, 924	2, 819, 916	1, 610, 189	6, 840, 029	$29, 894, 075	$4. 37
1921	1, 931, 243	1, 577, 335	1, 472, 576	4, 981, 154	24, 557, 966	4. 93
1922	2, 276, 683	2, 569, 042	1, 947, 124	6, 792, 849	27, 464, 838	4. 04
1923	2, 239, 872	2, 787, 239	2, 103, 602	7, 130, 713	27, 795, 941	3. 90
1924	2, 224, 555	2, 513, 853	2, 064, 707	6, 803, 115	25, 747, 048	3. 78
1925	2, 235, 170	2, 819, 690	2, 342, 640	7, 397, 500	26, 162, 361	3. 54
1926	2, 198, 060	3, 037, 820	2, 135, 720	7, 371, 600	25, 055, 012	3. 40
1927	2, 263, 030	3, 161, 800	2, 143, 860	7, 568, 690	24, 817, 962	3. 28
1928	2, 430, 050	3, 426, 870	2, 217, 780	8, 074, 700	26, 772, 568	3. 32
1929	2, 546, 390	3, 884, 160	2, 113, 010	8, 543, 560	27, 334, 695	3. 20

[1] The values are f. o. b. mine or refinery and do not include cost of cooperage or containers.

Louisiana and Utah were the only important producing States to show a decrease in output.

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[1] Work on manuscript completed August, 1930.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Salt sold or used by producers in the United States, 1926–1929, by States

State	1926		1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	288,440	$1,397,587	300,880	$1,827,750	383,730	$2,292,296	410,300	$2,432,329
Kansas	729,880	2,741,534	794,780	2,971,544	821,950	3,573,982	840,370	3,761,984
Louisiana	520,400	2,457,875	606,110	2,167,220	630,780	2,405,351	525,840	2,277,366
Michigan	2,260,320	7,594,418	2,271,460	7,551,552	2,405,240	8,249,437	2,650,220	8,343,607
New York	2,001,580	6,564,829	1,964,080	6,121,461	2,085,230	6,400,933	2,194,590	6,470,051
Ohio	1,164,400	3,209,473	1,203,170	3,130,236	1,308,110	2,988,862	1,449,360	3,199,903
Porto Rico	10,480	19,182	15,150	28,920	-----	-----	(1)	(1)
Texas	(1)	(1)	54,270	399,171	(1)	(1)	(1)	(1)
Utah	77,350	422,317	74,690	334,732	85,800	193,582	84,940	202,676
West Virginia	23,180	170,953	22,600	167,155	18,700	149,421	20,290	153,477
Undistributed [2]	295,570	476,844	261,500	118,221	335,160	518,704	367,650	493,302
	7,371,600	25,055,012	7,568,690	24,817,962	8,074,700	26,772,568	8,543,560	27,334,695

[1] Included under "Undistributed."

[2] 1926, Idaho, Nevada, New Mexico, Oklahoma, Texas, and Virginia; 1927, Arizona, Nevada, New Mexico, Oklahoma, and Virginia; 1928, Arizona, Nevada, New Mexico, Oklahoma, Texas, and Virginia; 1929, Nevada, New Mexico, Oklahoma, Porto Rico, Texas, and Virginia.

Salt sold or used by producers in the United States, 1928 and 1929, by methods of manufacture

Method of manufacture	1928		1929	
	Short tons	Value	Short tons	Value
Evaporated in open pans or grainers	710,400	$6,314,997	771,400	$6,597,434
Evaporated in vacuum pans [1]	1,193,560	8,791,138	1,201,560	8,414,636
Solar evaporated	380,370	1,510,574	401,310	1,517,425
Pressed blocks from evaporated salt	145,720	1,205,794	172,120	1,392,427
Rock	2,182,850	6,630,201	2,072,090	6,796,284
Pressed blocks from rock salt	34,930	293,626	40,920	331,397
Salt in brine (sold or used as such)	3,426,870	2,026,238	3,884,160	2,285,092
	8,074,700	26,772,568	8,543,560	27,334,695

[1] Including salt manufactured by the spray system of cooling in 1928.

New York, Louisiana, Kansas, and Michigan together produced 98 per cent of the rock salt mined in 1929.

Rock salt sold by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	1,610,189	$7,048,315	1925	2,342,640	$7,444,799
1921	1,472,576	6,693,923	1926	2,135,720	7,234,757
1922	1,947,124	7,489,644	1927	2,143,860	6,376,355
1923	2,103,602	7,843,419	1928	2,217,780	6,923,827
1924	2,064,707	7,501,419	1929	2,113,010	7,127,681

Evaporated salt sold or used by producers in the United States, 1928 and 1929, by States

State	1928		1929	
	Short tons	Value	Short tons	Value
California	366, 440	$2, 205, 826	385, 350	$2, 317, 533
Kansas	305, 630	2, 447, 439	306, 740	2, 282, 043
Michigan	913, 750	7, 062, 292	1, 025, 880	6, 960, 712
New York	379, 720	3, 322, 717	355, 350	3, 529, 185
Ohio	299, 110	1, 979, 862	303, 000	2, 053, 541
West Virginia	18, 700	149, 421	20, 290	153, 477
Undistributed [1]	146, 700	654, 946	149, 780	625, 431
	2, 430, 050	17, 822, 503	2, 546, 390	17, 921, 922

[1] 1928, Louisiana, Nevada, New Mexico, Oklahoma, Texas, and Utah; 1929, Louisiana, New Mexico, Oklahoma, Porto Rico, Texas, and Utah.

Sales of pressed blocks from evaporated salt and from rock salt, reported by producers of the salt, increased 18 and 17 per cent, respectively, in 1929. The production of these blocks from both evaporated salt and rock salt, as reported by the original producers of the salt and shown in the following table, does not represent the entire pressed-block industry, as some firms that do not produce salt make pressed blocks from salt bought in the open market. Pressed blocks from evaporated salt are made chiefly by salt producers in Kansas and Michigan but are also produced in Utah, Texas, Ohio, and California. Pressed blocks from rock salt are made chiefly by salt producers in Kansas and Louisiana, and small amounts are made in Utah and New York.

Pressed salt blocks sold by original producers of the salt in the United States, 1920–1929

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	114, 042	$1, 342, 830	15, 182	$172, 211	129, 224	$1, 515, 041
1921	97, 591	1, 106, 239	20, 148	169, 244	117, 739	1, 275, 483
1922	134, 089	1, 309, 255	38, 593	245, 174	172, 682	1, 554, 429
1923	128, 073	1, 263, 246	38, 043	281, 302	166, 116	1, 544, 548
1924	135, 720	1, 059, 484	36, 624	263, 260	172, 344	1, 322, 744
1925	135, 480	1, 069, 685	35, 730	206, 818	171, 210	1, 276, 503
1926	125, 670	1, 038, 292	28, 870	196, 414	154, 540	1, 234, 706
1927	150, 140	1, 251, 022	34, 420	230, 048	184, 560	1, 481, 070
1928	145, 720	1, 205, 794	34, 930	293, 626	180, 650	1, 499, 420
1929	172, 120	1, 392, 427	40, 920	331, 397	213, 040	1, 723, 824

IMPORTS AND EXPORTS

Salt imported for consumption in the United States, 1920–1929

Year	In bags, barrels, and other packages		In bulk		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	29, 567	$240, 923	108, 087	$435, 576	137, 654	$676, 499
1921	38, 374	333, 282	54, 721	197, 749	93, 095	531, 031
1922	[1] 24, 392	[1] 216, 718	89, 530	305, 620	113, 922	522, 338
1923	[1] 36, 185	[1] 240, 970	52, 565	142, 288	88, 750	383, 258
1924	[1] 40, 426	[1] 209, 641	48, 512	114, 451	88, 938	324, 092
1925	[1] 26, 973	[1] 188, 912	58, 815	127, 915	85, 788	316, 827
1926	[1] 29, 008	[1] 138, 356	26, 956	63, 887	55, 964	202, 243
1927	[1] 28, 773	[1] 125, 236	16, 195	42, 439	44, 968	167, 675
1928	[1] 18, 315	[1] 87, 654	24, 541	61, 905	42, 856	149, 559
1929	[1] 13, 197	[1] 71, 611	23, 253	60, 105	36, 450	131, 716

[1] Includes salt imported for curing fish, as follows: 1922, 2,252 short tons, valued at $5,549; 1923, 16,472 tons, $46,260; 1924, 27,096 tons, $61,581; 1925, 17,976 tons, $51,332; 1926, 24,310 tons, $50,915; 1927, 25,048 tons, $55,054; 1928, 14,710 tons, $34,777; 1929, 8,812 tons, $23,258.

Salt imported into the United States, 1926–1929, by countries

[General imports]

Country	1926		1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
North America:								
Canada	2, 931, 833	$4, 884	430, 246	$1, 625	1, 332, 557	$5, 470	2, 051, 172	$7, 697
Mexico	1, 486, 152	2, 637	20, 000	98	4, 743, 659	12, 940	990, 000	1, 485
West Indies—								
British—								
Jamaica	10, 997, 900	16, 403	10, 616, 050	14, 634	23, 137, 510	25, 914	23, 550, 823	28, 806
Other British	30, 946, 870	37, 145	4, 952, 170	6, 041	15, 911, 627	18, 107	16, 971, 389	22, 837
Dominican Republic	----------	--------	67, 500	163	----------	--------	----------	--------
French	112, 240	173	389, 000	944	125, 200	377	----------	--------
Netherland	5, 040, 610	6, 085	6, 031, 594	9, 541	1, 497, 655	2, 362	2, 444, 416	4, 186
South America: Peru	----------	--------	1, 036	38	----------	--------	----------	--------
Europe:								
France	2, 505	32	----------	--------	----------	--------	79	20
Germany	7, 031, 969	12, 697	1, 692, 501	8, 465	2, 909, 598	11, 403	4, 110, 616	12, 457
Greece	----------	--------	----------	--------	11, 108	121	----------	--------
Italy	----------	--------	14, 874, 000	12, 068	----------	--------	----------	--------
Netherlands	----------	--------	----------	--------	828	75	----------	--------
Spain	44, 127, 543	39, 501	49, 024, 640	49, 666	28, 560, 000	28, 578	34, 955, 200	36, 606
Switzerland	----------	--------	22	5	----------	--------	----------	--------
Turkey in Europe	56, 000	484	----------	--------	----------	--------	----------	--------
United Kingdom	9, 379, 063	87, 210	7, 208, 548	64, 241	5, 819, 163	44, 344	6, 438, 636	37, 570
Asia: Japan	1, 120	24	1, 070	21	----------	--------	----------	--------
Africa:								
Algeria and Tunisia	9, 240, 320	7, 644	----------	--------	----------	--------	----------	--------
Portuguese	100, 800	90	536, 000	970	----------	--------	163, 000	99
	121, 454, 925	215, 009	95, 844, 377	168, 520	84, 048, 905	149, 691	91, 675, 331	151, 763

Salt exported from the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	139, 272	$1, 901, 593	1925	155, 079	$1, 219, 935
1921	109, 563	1, 415, 471	1926	158, 908	1, 277, 790
1922	134, 989	1, 429, 172	1927	153, 832	1, 329, 980
1923	125, 529	1, 211, 226	1928	145, 396	1, 185, 682
1924	144, 945	1, 288, 376	1929	109, 222	1, 008, 842

Salt exported from the United States, 1926–1929, by countries

Country	1926		1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
North America:								
Bermuda	148, 867	$2, 174	158, 027	$2, 411	100, 460	$1, 935	104, 832	$1, 285
British Honduras	416, 170	3, 332	676, 601	4, 363	865, 495	4, 965	717, 898	5, 224
Canada	225, 134, 503	697, 230	219, 434, 815	744, 932	223, 256, 071	736, 007	172, 298, 827	570, 921
Central American States—								
Costa Rica	134, 500	1, 585	147, 060	2, 045	161, 749	1, 912	323, 709	3, 187
Guatemala	292, 907	4, 139	602, 815	4, 618	603, 386	5, 135	1, 147, 823	8, 482
Honduras	2, 231, 638	20, 412	4, 674, 156	33, 025	3, 706, 772	24, 516	2, 046, 741	17, 632
Nicaragua	688, 778	8, 284	1, 112, 967	11, 190	998, 931	10, 298	749, 505	11, 672
Panama	1, 903, 410	17, 188	1, 470, 556	13, 571	1, 631, 501	12, 862	1, 577, 504	15, 340
Salvador	376	19	3, 048	47	548	19	886	29
Mexico	16, 043, 576	126, 619	17, 196, 038	144, 557	11, 785, 593	110, 712	9, 066, 490	99, 606
Miquelon, Langley, etc	3, 080	93	2, 616	67	2, 558	75	2, 976	108
Newfoundland and Labrador	128, 800	575	----------	--------	48, 925	511	639, 010	3, 253
West Indies—								
British—								
Jamaica	47, 462	315	67, 997	537	172	12	2, 400	72
Trinidad and Tobago	----------	--------	----------	--------	----------	--------	1, 400	19
Other British	24, 639	486	70, 414	737	8, 534	366	14, 068	558
Cuba	64, 815, 515	315, 423	56, 029, 595	280, 566	40, 217, 746	168, 484	20, 703, 211	138, 955
Dominican Republic	34, 756	1, 075	187, 278	1, 731	27, 886	818	69, 705	1, 649
French	----------	--------	----------	--------	600, 000	900	----------	--------
Haiti	10, 816	419	10, 307	376	12, 235	398	7, 328	250
Netherland	201	5	5, 445	103	15, 815	241	129, 304	1, 724
Virgin Islands of the United States	4, 444	136	27, 393	233	812, 000	742	629, 732	2, 557
South America:								
Argentina	87, 534	1, 537	2, 072	99	133, 761	1, 785	5, 428	216
Bolivia	----------	--------	50	4	----------	--------	----------	--------
Brazil	----------	--------	----------	--------	----------	--------	17, 444	1, 152
Chile	3, 360	129	2, 448	105	4, 700	163	4, 800	186
Colombia	55, 307	1, 222	139, 746	1, 740	68, 596	1, 225	62, 850	1, 304
Ecuador	25, 896	442	3, 654	566	2, 393	79	1, 164	109
Guiana—Surinam (Netherland)	----------	--------	330	14	----------	--------	192	4
Paraguay	2, 425	90	2, 450	89	2, 400	90	600	15
Peru	----------	--------	----------	--------	----------	--------	550	55
Venezuela	145	11	900	16	30, 000	176	52, 610	446
Europe:								
Denmark	----------	--------	----------	--------	3, 185	166	600	40
France	27, 000	245	8, 000	72	10, 060	81	14, 136	221
Germany	----------	--------	110, 380	1, 015	92, 215	800	----------	--------
Iceland and Faroe Islands	----------	--------	----------	--------	----------	--------	12, 544	892
Irish Free State	----------	--------	----------	--------	----------	--------	1, 000	38
Italy	----------	--------	----------	--------	----------	--------	124	3
Netherlands	----------	--------	7, 531	27	10, 342	39	7, 609	82
Norway	----------	--------	400	21	----------	--------	----------	--------
Portugal	----------	--------	----------	--------	----------	--------	1, 000	26
Soviet Russia	432	12	----------	--------	----------	--------	----------	--------
Turkey in Europe	----------	--------	330	11	----------	--------	----------	--------
United Kingdom	82, 512	793	208, 104	1, 228	467, 542	3, 271	130, 984	1, 002
Asia:								
Ceylon	2, 940	272	5, 848	359	2, 024	185	3, 202	237
China	56, 178	3, 774	50, 675	2, 764	151, 991	7, 852	228, 980	3, 245
East Indies—								
British—								
India	7, 594	687	16, 266	710	6, 045	780	5, 398	450
Malaya	2, 158	159	6, 106	375	3, 208	199	2, 051	152
Netherland—								
Java and Madura	3, 278	262	5, 150	206	16, 684	699	22, 972	1, 066
Other	100	10	120	14	2, 492	79	6, 168	364
Hong Kong	40, 041	2, 269	33, 742	1, 814	61, 306	2, 423	46, 200	2, 625
Indo-China, French	----------	--------	1, 456	70	3, 944	197	5, 512	308
Iraq	----------	--------	----------	--------	208	10	----------	--------
Japan	76, 555	467	431, 042	1, 920	398, 046	3, 860	827, 643	6, 981
Kwantung	3, 520	234	3, 355	248	5, 400	407	7, 606	326
Persia	----------	--------	172	11	----------	--------	864	41
Philippine Islands	338, 026	10, 125	236, 730	7, 289	313, 293	9, 742	388, 567	8, 650
Siam	5, 190	461	4, 270	370	4, 382	400	3, 160	246
Soviet Russia	110, 390	632	101, 500	471	170, 000	1, 242	150, 300	1, 207
Syria	----------	--------	4, 520	132	----------	--------	16, 000	525
Other	624	30	----------	--------	----------	--------	----------	--------

Salt exported from the United States, 1926–1929, by countries—Continued

Country	1926		1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:								
British—								
East	-----	-----	-----	-----	-----	-----	120	$4
South (Union of)	-----	-----	324	$14	-----	-----	480	20
West	-----	-----	2,259	40	-----	-----	-----	-----
Liberia	-----	-----	123	38	2,259	$38	-----	-----
Morocco	-----	-----	-----	-----	3,280	44	-----	-----
Portuguese ("Other")	240	$25	120	12	-----	-----	-----	-----
Oceania:								
British—								
Australia	4,365,861	47,479	3,661,155	53,315	3,135,376	56,281	5,651,398	84,039
New Zealand	192,030	3,621	440,533	6,356	403,462	6,947	206,507	5,554
Other British	56,850	1,123	27,279	528	32,665	637	84,808	1,389
French	205,502	2,170	267,368	2,808	394,862	4,877	238,247	3,099
	317,816,126	1,277,790	307,663,636	1,329,980	290,792,498	1,185,682	218,443,167	1,008,842

WORLD PRODUCTION

World production of salt, 1924–1928, in metric tons

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country [1]	1924	1925	1926	1927	1928
North America:					
Canada	191,176	216,729	235,938	245,756	273,525
Cuba	(2)	(2)	(2)	411	2,359
Guatemala	(2)	57	4,805	225	(2)
Mexico [3]	67,000	67,000	67,000	67,000	67,000
Panama	(2)	(2)	1,280	1,149	835
United States—					
Rock salt	1,873,061	2,125,196	1,937,482	1,944,867	2,011,926
Other salt	4,298,589	4,585,668	4,749,886	4,921,297	5,313,281
West Indies—					
British—					
Bahamas [4]	1,595	1,312	7,476	1,923	725
Grenada (Windward Islands) [4]	54	71	56	-----	(2)
Leeward Islands [4]	1,207	802	614	1,214	1,586
Turks and Caicos Islands [4]	53,167	63,434	54,824	28,371	50,846
Netherland [4]	8,894	18,377	10,159	8,218	9,778
South America:					
Argentina [5]	122,432	75,351	96,655	153,213	167,617
Chile	36,093	29,334	34,903	71,549	34,746
Colombia [3]	29,000	29,000	29,000	29,000	29,000
Ecuador—					
Rock salt	(2)	(2)	(2)	628	333
Other salt	(2)	(2)	(2)	16,100	10,051
Peru	28,979	28,371	30,114	29,997	32,669
Venezuela [3]	30,000	30,000	30,000	30,000	30,000
Europe:					
Albania	(2)	(2)	5,596	6,600	5,283
Austria—					
Rock salt	2,744	2,087	3,227	2,675	1,607
Other salt	108,425	128,720	141,914	145,405	152,212
Bulgaria	19,000	10,400	14,000	34,962	35,790
Czechoslovakia	124,773	76,826	98,105	122,202	154,243
France—					
Rock salt and salt from springs	1,317,908	1,458,420	1,643,360	1,336,400	1,596,925
Other salt	256,943	262,008	467,610	(2)	(2)
Germany—					
Rock salt	1,596,416	1,767,282	1,965,847	2,268,807	2,399,669
Other salt	377,277	456,810	479,547	533,984	509,663
Greece	68,542	79,316	89,726	104,378	(2)
Italy—					
Rock salt	56,896	63,984	67,610	66,850	67,187
Other salt	750,424	851,653	698,642	984,124	836,201
Netherlands—Rock salt	32,054	34,053	34,505	40,596	41,858
Poland	371,182	429,988	457,503	498,435	548,377
Portugal [4]	90,804	33,744	49,404	49,552	(2)
Rumania	302,761	330,356	344,062	328,028	340,212
Russia [6]	1,235,173	1,377,624	1,685,717	2,216,136	[7] 2,323,262

Footnotes at end of table

World production of salt, 1924–1928, in metric tons—Continued

Country	1924	1925	1926	1927	1928
Europe—Continued.					
Spain—					
Rock salt	105, 450	106, 627	118, 581	110, 839	146, 147
Other salt	862, 856	753, 514	978, 688	868, 381	836, 912
Switzerland	71, 815	75, 141	77, 267	78, 262	79, 982
United Kingdom—					
Great Britain—					
Rock salt	43, 076	35, 281	35, 152	22, 809	24, 254
Other salt	2, 016, 914	1, 912, 061	1, 708, 864	1, 985, 250	1, 938, 575
Ireland, Northern—					
Rock salt	11, 235	10, 052	6, 191	7, 262	7, 598
Other salt	7, 370	7, 230	4, 960	(2)	7, 130
Yugoslavia	48, 864	48, 499	52, 260	54, 765	52, 128
Asia:					
Ceylon	9, 412	20, 588	16, 218	26, 080	44, 275
China (including Kwantung)	[3] 3, 600, 000	[8] 3, 639, 000	[3] 3, 600, 000	[8] 2, 067, 269	[3] 2, 000, 000
Cyprus [3]	3, 000	3, 000	3, 000	3, 000	3, 000
India—					
British (including Aden)—					
Rock salt	192, 274	152, 794	149, 025	173, 489	157, 846
Other salt	1, 457, 258	1, 163, 137	1, 516, 026	1, 464, 328	1, 381, 824
Portuguese [3]	12, 000	12, 000	12, 000	12, 000	12, 000
Indo-China [4]	4, 251	5, 955	20, 456	27, 701	35, 815
Japan—					
Japan proper [9]	637, 169	668, 682	614, 134	619, 138	637, 888
Taiwan	136, 200	138, 000	135, 232	113, 400	134, 515
Netherland East Indies	131, 860	441, 608	381, 402	251, 655	242, 347
Palestine	2, 600	5, 600	(2)	7, 014	1, 681
Philippine Islands	28, 919	30, 683	24, 075	66, 669	71, 475
Russia [6]	93, 929	227, 170	166, 886	209, 830	(7)
Siam	[10] 40, 564	126, 086	125, 670	115, 356	119, 332
Turkey [3]	100, 000	100, 000	100, 000	100, 000	100, 000
Africa:					
Algeria	23, 541	27, 005	43, 216	36, 936	10, 975
Belgian Congo [3]	80	80	80	80	84
Egypt [4]	209, 900	211, 130	180, 241	222, 535	167, 870
Eritrea	[3] 60, 000	[3] 60, 000	65, 000	68, 000	[3] 60, 000
Ethiopia—Rock salt	(2)	(2)	(2)	25, 000	20, 000
Mauritania	(2)	4, 500	4, 500	4, 300	4, 000
Mauritius [3]	1, 500	1, 500	1, 500	1, 500	1, 500
Morocco, French	3, 000	3, 500	1, 200	(2)	(2)
Nigeria [3]	400	400	400	400	400
Portuguese West Africa (Angola) [3]	9, 000	9, 000	9, 000	9, 000	9, 000
Somaliland—					
British [3]	15, 000	15, 000	15, 000	15, 000	15, 000
French	[3] 15, 000	[3] 15, 000	[3] 15, 000	18, 444	39, 000
South-West Africa—Rock salt	340	432	363	343	151
Sudan, Anglo-Egyptian	[11] 9, 238	[11] 7, 020	[11] 9, 333	[3] 9, 000	[3] 9, 000
Tanganyika Territory	4, 629	4, 000	3, 155	4, 852	5, 134
Tripolitania [3]	2, 000	2, 000	2, 000	2, 000	2, 000
Tunisia	123, 606	128, 442	132, 080	144, 788	114, 045
Uganda	(2)	1, 399	1, 743	2, 049	2, 067
Union of South Africa [12]	70, 369	59, 269	80, 517	80, 416	88, 500
Oceania:					
Australia—					
South Australia	63, 693	79, 507	92, 563	80, 559	72, 574
Victoria	[3] 40, 000	[3] 40, 000	[3] 40, 000	36, 503	52, 181
Western Australia [3]	8, 000	8, 000	8, 000	8, 000	8, 000

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[1] In addition to the countries listed, salt is produced in Arabia, Bolivia, Brazil, Chosen, Gold Coast, Kenya Colony, Madagascar, and Southern Rhodesia, but figures of production are not available.

[2] Data not available.

[3] Estimated annual production.

[4] Exports.

[5] Railway shipments.

[6] Year ended Sept. 30.

[7] Russia in Asia included with Russia in Europe.

[8] Figures of production as published by the Geological Survey of China, Peiping.

[9] Year ended Mar. 31 of year following that stated. The figures do not include output from salt beds which, though situated on Government beach lands, have no fixed areas.

[10] Exports for year ended Mar. 31 of year following that stated.

[11] Shipments from Raiwaya field.

[12] Year ended June 30.

LOCALITIES PRODUCING SALT IN THE UNITED STATES IN 1929

The salt deposits in the United States that furnish salt for commercial purposes are, with the exception of small deposits used for local supply, confined to definite regions in the northeastern, south central, and western parts of the country. Michigan, New York, and Ohio, included in the first group, furnished 74 per cent of the total salt sold or used by producers in 1929 compared with 72 per cent in 1928. Kansas and Louisiana, in the central belt of States, are the next largest producers and California is chief among the Western States.

The salt is marketed as evaporated salt and as rock salt. Salt brine is drawn from wells by several chemical manufacturers, and the salt content is used by them in their manufacturing processes. Bittern water, or the residue from some of the salt works, is sold to chemical manufacturers for further treatment and for the recovery of bromine and calcium chloride.

The producing companies in 1929, the location of their plants, and the nature of the salt sold or used by them, as reported to the Bureau of Mines, are given by States on the following pages to furnish information often requested regarding the operation of salt properties.

CALIFORNIA

In California salt is obtained from sea water, from salt springs, lakes, etc., and rock salt. The greater part of the production is from the solar evaporation of sea water, especially along the shores of San Francisco Bay in Alameda and San Mateo Counties. Reports were received in 1929 from the following:

Alameda County:
  Alvarado—Leslie-California Salt Co. (address, 155 Montgomery Street, San Francisco); evaporated salt (solar, vacuum pans), pressed blocks from evaporated salt.
  Mount Eden—Oliver Salt Co. (address, 155 Montgomery Street, San Francisco); evaporated salt (open pans or grainers), solar. Plant operated by Leslie-California Salt Co.
  Mount Eden and Newark—Arden Salt Co. (address, 225 Bush Street, San Francisco); solar evaporation.
  Newark—Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); evaporated salt (solar, vacuum pans), pressed blocks from evaporated salt.
Inyo County: Keeler (Saline Valley)—Sierra Salt Corporation (address, 512 South Alameda Street, Los Angeles); solar evaporation.
Kern County: Saltdale (Ceneda)—Consolidated Salt Co. of California (address, Long Beach). On a playa known as Cane Lake; solar evaporation.
Los Angeles County: Long Beach (Anaheim Road)—Long Beach Salt Co.; solar evaporation.
Modoc County: Cedarville—Surprise Valley Salt Works; solar evaporation.
Monterey County: Moss Landing—Monterey Bay Salt Co.; solar evaporation.
San Bernardino County:
  Amboy (Saltus)—California Rock Salt Co. (address, 2465 Hunter Street, Los Angeles); rock salt, also calcium chloride from Amboy playa.
  ——— Saline Products (Inc.) (address, 2000 Santa Fe Avenue, Los Angeles); rock salt, also calcium chloride.
San Diego County: San Diego (south end of San Diego Bay)—Western Salt Co.; solar evaporation.

San Mateo County:
  Leslie—Leslie-California Salt Co. (address, 155 Montgomery Street, San Francisco); evaporated salt (solar, vacuum pans), pressed blocks from evaporated salt.
  Redwood City—Stauffer Chemical Co. (address, 636 California Street, San Francisco); solar evaporation.
Santa Clara County: Alviso—Alviso Salt Co. Plant under construction.

KANSAS

In 1929 Kansas again ranked fourth among the salt-producing States. The salt sold in the State is rock salt and evaporated salt made from brines obtained from solution of rock salt. The companies reporting in 1929 were as follows:

Ellsworth County:
  Kanopolis—Crystal Salt Co. (address, Equitable Building, Denver, Colo.); rock salt.
  ——— Independent Salt Co. (address, 33 South Clark Street, Chicago, Ill.); rock salt.
Harper County: Anthony—Western Ice & Utilities Co.; evaporated salt (open pans or grainers), pressed blocks from evaporated salt, rock salt, pressed blocks from rock salt.
Reno County:
  Hutchinson—The Barton Salt Co.; evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
  ——— Carey Salt Co. (east plant); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
  ——— ——— (rock salt mine); rock salt, pressed blocks from rock salt.
  ——— Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
Rice County:
  Lyons—American Salt Corporation (address, La Salle Building, Kansas City, Mo.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt, rock salt, pressed blocks from rock salt.
  ——— Diamond Crystal Salt Co. (successor to Western Salt Co.) (address, Manufacturers Exchange, Kansas City, Mo.); evaporated salt (vacuum pans), pressed blocks from evaporated salt, rock salt, pressed blocks from rock salt.
  Sterling—Sterling Salt Co.; evaporated salt (open pans or grainers).

LOUISIANA

Louisiana in 1929 again ranked fifth in the quantity of salt produced. Rock salt and evaporated salt are produced. The firms reporting in 1929 were:

Iberia Parish:
  Avery Island—Avery Rock Salt Mining Co. (address, Scranton, Pa.); rock salt.
  Jefferson Island—Jefferson Island Salt Mining Co. (Inc.) (address, 324 West Main Street, Louisville, Ky.); rock salt, pressed blocks from rock salt.
  Weeks Island—Myles Salt Co. (Ltd.) (address, 1007 Camp Street, New Orleans); rock salt, pressed blocks from rock salt.
St. Martin Parish: Lafayette—Star Salt Corporation; evaporated salt (vacuum pans).

MICHIGAN

Michigan in 1929 again ranked first among the salt-producing States. The output is obtained from both rock salt and natural brine. In 1929 reports of production were received from the following companies:

Bay County: Bay City—Halverson Lumber & Salt Co.; evaporated salt (grainers).

Manistee County: Manistee—Ruggles & Rademaker; evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt, also bromine.

Mason County: Ludington—Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.

Midland County: Midland—The Dow Chemical Co.; evaporated salt (vacuum pans), also bromine, magnesium chloride, and calcium chloride.

Saginaw County:
- Carrollton—Mershon, Eddy, Parker Co. (address, Saginaw); evaporated salt (open pans or grainers).
- ——— Saginaw Salt Products Co. (address, Saginaw); evaporated salt (open pans or grainers).
- Saginaw—Strable Lumber & Salt Co.; evaporated salt (open pans or grainers).

St. Clair County:
- Marine City—Michigan Salt Works; evaporated salt (open pans or grainers, vacuum pans).
- Port Huron—Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
- St. Clair—Diamond Crystal Salt Co.; evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.

Wayne County:
- Delray—The Solvay Process Co. (address, Syracuse, N. Y.); brine for the manufacture of chemicals.
- Detroit—Detroit Rock Salt Co. (address, Scranton, Pa.); rock salt.
- ——— Mulkey Salt Co.; evaporated salt (open pans or grainers, vacuum pans). Plant abandoned April, 1929.
- Ecorse—Worcester Salt Co. (address, 71 Murray Street, New York, N. Y.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
- Wyandotte—Michigan Alkali Co.; brine for the manufacture of chemicals.
- ——— Pennsylvania Salt Manufacturing Co. (address, Widener Building, Philadelphia, Pa.); evaporated salt (open pans or grainers), brine for the manufacture of chemicals.

NEVADA

In 1929 small quantities of rock salt were produced at St. Thomas, Clark County, on the property of the Virgin River Salt Co. The Nevada Pure Salt Co. (address, Gazette Building, Reno), operated at Fallon, Churchill County, in 1929, but made no shipments.

NEW MEXICO

Production of salt in New Mexico in 1929 was reported at Salt Lake, Catron County, by Frank A. Hubbell Co., of Albuquerque, and near Willard, Torrance County, by the New Mexico Salt Co.

NEW YORK

New York in 1929 again ranked second among the salt-producing States. Both evaporated and rock salt are supplied by producers, but the entire product is from rock salt. Brine for evaporated salt is obtained by dissolving the rock salt with water that is allowed to flow into the beds and is pumped out when saturated. The producing companies in 1929 were as follows:

Livingston County:
  Cuylerville (Halite)—Sterling Salt Co. (address, 40 West Fortieth Street, New York); rock salt, pressed blocks from rock salt.
  Piffard—Worcester Salt Co. (address, 71 Murray Street, New York); evaporated salt (open pans or grainers, vacuum pans).
  Retsof—Retsof Mining Co. (address, Scranton, Pa.); rock salt.
Onondaga County: Solvay and Tully—The Solvay Process Co. (address, Syracuse); evaporated salt (vacuum pans), brine for the manufacture of chemicals and refined salt as a by-product.
Schuyler County:
  Watkins Glen—International Salt Co. (address, Scranton, Pa.); evaporated salt (open pans or grainers, vacuum pans).
  ——— The Watkins Salt Co.; evaporated salt (open pans or grainers).
Tompkins County:
  Ludlowville—International Salt Co. (address, Scranton, Pa.); evaporated salt (open pans or grainers, vacuum pans).
  Myers—Cayuga Rock Salt Co. (Inc.); rock salt.
Wyoming County: Silver Springs—Worcester Salt Co. (address, 71 Murray Street, New York); evaporated salt (open pans or grainers, vacuum pans).

OHIO

Ohio in 1929 again ranked third in the production of salt. The larger part of the output is used in the form of brine for the manufacture of chemicals.

Cuyahoga County: Cleveland—The Union Salt Co.; evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
Lake County: Painesville—Diamond Alkali Co. (address, 436 Seventh Avenue, Pittsburgh, Pa.); brine for the manufacture of chemicals.
Meigs County:
  Minersville—Pomeroy Salt Corporation (address, Pomeroy); evaporated salt (open pans or grainers), also bromine and calcium chloride.
  Pomeroy—The Excelsior Salt Works; evaporated salt (open pans or grainers), also bromine and calcium chloride.
Summit County:
  Barberton—Pittsburgh Plate Glass Co.; brine for the manufacture of chemicals.
  Kenmore—The Colonial Salt Co. (address, Akron); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.
Wayne County: Rittman—The Ohio Salt Co. (address, Wadsworth); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.

OKLAHOMA

Evaporated salt is taken from playas and lagoons and used locally as cattle salt; in 1929 C. O. Carpenter and Y. L. Stockman each reported sales of small amounts of such salt from near Vinson, Harmon County.

PORTO RICO

In 1928 the salt plants in Porto Rico were badly damaged by a hurricane, and although some salt was produced no output was reported to the Bureau of Mines. In 1929 two plants reported production, with largely increased cost of operation. They were as follows:

Cabo Rojo—F. Carrera & Hno. (address, Mayaguez); solar evaporation.
Lajas—Miguel Antonio Ramirez Dominguez (address, San German); solar evaporation.

TEXAS

Salt was produced in Texas in 1929 as follows:

Anderson County: Palestine—Palestine Salt & Coal Co.; evaporated salt (open pans or grainers), pressed blocks from evaporated salt.
Fort Bend County: Hobby—Texas Salt Co. (address, Esperson Building, Houston). Plant in course of construction.
Van Zandt County: Grand Saline—Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); evaporated salt (open pans or grainers, vacuum pans), pressed blocks from evaporated salt.

Salt formed by the evaporation of the waters of playas and lagoons is also used locally by cattlemen but there is no record of the quantity so used.

UTAH

Production of salt in Utah in 1929 was reported by the following companies:

Salt Lake County: Saltair—Royal Crystal Salt Co. (address, 133 Regent Street, Salt Lake City); solar evaporation, pressed blocks from evaporated salt.
Sanpete County: Axtell—Royal Crystal Salt Co. (address, 133 Regent Street, Salt Lake City); rock salt.
Sevier County:
  Redmond—Great Western Salt Co.; rock salt, pressed blocks from rock salt.
  ——— Paulson Bros.; rock salt.
Tooele County: Burmester—Morton Salt Co. (address, 208 West Washington Street, Chicago, Ill.); solar evaporation, pressed blocks from evaporated salt.

VIRGINIA

Salt brine is produced in Virginia at Saltville, Smyth County, by the Mathieson Alkali Works (Inc.) for the manufacture of chemicals.

WEST VIRGINIA

The salt made in West Virginia is all obtained from natural brines. In 1929 the operators were as follows:

Kanawha County:
  Malden—J. Q. Dickinson & Co.; evaporated salt (open pans or grainers), also bromine and calcium chloride.
  South Charleston—Westvaco Chlorine Products (Inc.); brine used in the manufacture of chlorine.
Mason County:
  Hartford—Liverpool Salt & Coal Co.; evaporated salt (open pans or grainers), also bromine and calcium chloride.
  Mason—Ohio River Salt Corporation; evaporated salt (open pans or grainers), also bromine and calcium chloride.

BROMINE

In 1929 the bromine recovered by the producers from natural brine and the bromine content of bitterns used by producers in the manufacture of bromine compounds was nearly three times the quantity reported for 1928. This increase was due to the increased demand for ethylene dibromide used in the manufacture of ethyl gasoline. The larger part of the bromine output as reported is not sold as bromine but as potassium and sodium bromide and other salts. The figures given in the following table include the bromine content of these salts.

The plants operated in 1929 were those of the California Chemical Corporation (address, 233 Sansome Street, San Francisco), Chula Vista, Calif.; Ruggles & Rademaker, Manistee, Mich.; The Dow Chemical Co., Midland, Mich.; Pomeroy Salt Corporation (address, Pomeroy, Ohio), Minersville, Ohio; The Excelsior Salt Works, Pomeroy, Ohio; J. Q. Dickinson & Co., Malden, W. Va.; Liverpool Salt & Coal Co., Hartford, W. Va.; and Ohio River Salt Corporation, Mason, W. Va. So far as the Bureau of Mines is informed no bromine was produced directly from sea water in 1929.

Bromine and bromine in compounds sold or used by producers in the United States, 1920–1929

Year	Pounds	Value	Year	Pounds	Value
1920	1,160,584	$745,381	1925	1,566,120	$488,406
1921	711,953	172,759	1926	1,245,760	426,837
1922	1,005,174	150,668	1927	1,756,310	564,689
1923	842,352	146,176	1928	2,164,000	649,475
1924	2,033,804	594,685	1929	6,414,620	1,759,325

The figures for the value of bromine, as reported to the Bureau of Mines by the producers, represent the value of the bromine f. o. b. at the plants or shipping point. The average unit value for 1929 was 27 cents a pound, as compared with 30 cents a pound in 1928 and 32 cents in 1927. The wholesale price per pound of bulk bromine in 1929 as quoted in the New York market was, according to Chemical & Metallurgical Engineering, 45 to 47 cents a pound, the same as in 1926, 1927, and 1928.

The following table shows the imports of bromine and bromine compounds into the United States from 1925 to 1929.

Bromine and bromine compounds imported for consumption in the United States, 1925–1929

Product	1925		1926		1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Bromine	8,009	$2,110	37,839	$14,486					17,573	$5,804
Potassium bromide	237,231	62,028	70,440	18,549	20,813	$7,075	23,231	$7,918	28,310	9,834
Sodium bromide	208,434	52,230	212,365	73,313	1,102	370			110	51
Ethylene dibromide	117,867	46,784	271,645	102,894	465,048	144,167	283,205	86,966	443,004	104,917
Other bromine compounds							27,730	2,857	643	572

CALCIUM CHLORIDE

The calcium chloride reported in the following table is an original constituent of the natural brine produced in connection with the extraction of salt or salt and bromine from mineral raw materials only. A further large output of calcium chloride made by manufacturing processes used in chemical industries is not reported. The calcium chloride reported includes an output of mixed calcium and magnesium chlorides and other salts. There was an increase of 12 per cent in the quantity of this product sold by the producers in 1929, as compared with 1928, and 1929 was the eighth year of increase. The calcium chloride here reported for 1929 was produced by the California Rock Salt Co. (address, 2465 Hunter Street, Los Angeles), Saltus, Calif.; Saline Products (Inc.) (address, 2000 Santa Fe Avenue, Los Angeles), Amboy, Calif.; The Dow Chemical Co., Midland, Mich.; Pomeroy Salt Corporation (address, Pomeroy, Ohio), Minersville, Ohio; The Excelsior Salt Works, Pomeroy, Ohio; J. Q. Dickinson & Co., Malden, W. Va.; Liverpool Salt & Coal Co., Hartford, W. Va.; and Ohio River Salt Corporation, Mason, W. Va.

Calcium (calcium-magnesium) chloride from natural brines sold by producers in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	27,849	$539,471	1925	67,870	$1,386,639
1921	23,672	510,723	1926	82,340	1,710,405
1922	33,067	571,326	1927	95,721	1,947,797
1923	44,961	663,384	1928	102,090	1,995,603
1924	58,791	1,164,848	1929	114,240	2,097,061

Imports of calcium chloride were not separately recorded by the Bureau of Foreign and Domestic Commerce prior to the change in tariff, September 22, 1922. The figures for imports since that time are shown in the following table:

Calcium chloride imported for consumption in the United States, September 22, 1922, to December 31, 1929

Year	Short tons	Value	Year	Short tons	Value
1922 (Sept. 22 to Dec. 31)	740	$8,563	1926	7,372	$96,742
1923	3,232	48,527	1927	6,514	85,456
1924	3,996	54,542	1928	9,263	100,223
1925	2,253	37,121	1929	8,236	113,573

Exports of calcium chloride were not separately recorded until 1929, when 15,425 short tons, valued at $362,658, was exported.

SLATE[1]

By Oliver Bowles and A. T. Coons[2]

CONDITIONS IN THE INDUSTRY

Slate sold by producers in the United States in 1929 was valued at $11,245,178, a decrease of 2 per cent from the value for 1928. The quantity of slate sold in 1929, approximately 670,070 short tons, represented an increase of 4 per cent over 1928. Slate sold in the form of slate granules or "flour," which represents the largest part of the output of slate products, showed an increase in quantity but not a corresponding increase in value.

There was a decrease of 4 per cent in the number of squares of roofing slate sold in 1929, compared with 1928, and a decrease of 9 per cent in their total value; the average value per square in 1929 was $10.65, compared with $11.20 in 1928.

Total sales of mill stock in 1929 amounted to 9,936,480 square feet, valued at $3,702,145, an increase of 8 per cent in quantity and of 9 per cent in value. The increases in mill stock were in slate for electrical use, 13 per cent; for structural and sanitary uses, 29 per cent; and for school slates, 16 per cent. Slate for vaults and covers decreased 3 per cent; for blackboards and bulletin boards, 4 per cent; and for billiard-table tops, 45 per cent. Slate for walk ways, flagstones, crosswalks, stepping-stones, and similar uses has steadily increased in production the last few years; an increase of 34 per cent over 1928 was reported for 1929.

Sales of crushed slate in the form of granules and slate flour amounted to 428,940 short tons, valued at $2,497,743, in 1929—an increase of 4 per cent in quantity and 1 per cent in value compared with 1928. The slate flour included in this total amounted to 33,110 tons, valued at $176,413. A quantity of crushed slate sold as a filler for fertilizer was also included. The total average value was $5.82 a ton in 1929, compared with $5.96 in 1928. Other stone, chiefly a "greenstone" (an altered diabase) crushed into granules and sold in 1929, amounted to 153,870 short tons, valued at $931,781, as shown in the chapter of this series on Stone.

The slate-quarrying companies that reported sales in 1929 numbered 127, or 14 more than in 1928. In New York and Vermont many small quarries are intermittently worked on a small scale for roofing slate. The product of these quarries is generally sold with that of some of the larger quarries, and much of it consists of "freak" or odd-colored slate of unusual size or thickness for use in special work.

As slate from many of the small producers is sold by the larger producing companies, the possibility of duplication of returns must be considered in the compilation of operators' reports. In preparing this report special care has been taken to avoid duplication.

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[1] Work on manuscript completed August, 1930.

[2] The figures on imports and exports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce, except as otherwise indicated.

DEFINITION OF SLATE

The standard definition of slate established by the American Society for Testing Materials reads as follows: "A microgranular crystalline stone derived from argillaceous sediments by regional metamorphism, and characterized by a perfect cleavage entirely independent of original bedding, which cleavage has been induced by pressure within the earth." The perfect cleavage, which permits of its being split into smooth, thin sheets, is its most striking characteristic.

ORIGIN AND OCCURRENCE

Commercial slates have originated from sedimentary deposits consisting largely of clay. Under pressure of superimposed materials the clays have been compressed into laminated shales. The mountain-building forces ever at work in the earth's crust have folded and compressed the shales, and the intense pressure and high temperature have altered the original clay matter into extremely fine-grained mica, quartz, chlorite, and other minerals. The pressure has also changed the orientation of the flakelike grains, causing them to assume a parallel position lying at a more or less definite angle to the direction of pressure. This parallelism of the mineral grains gives to slate its characteristic slaty cleavage.

Although rocks commonly designated as slate are of common occurrence, as, for example, the "bone" or slate associated with coal, it is only in relatively few localities that slate of commercial quality appears. These localities are described in a later section of this report.

PHYSICAL PROPERTIES

High-grade slates, such as those commonly sold, possess low absorption and high tensile strength. The colors are quite variable, those in Virginia, Pennsylvania, Maryland, and Maine ranging from light gray to blue black. The slates of New York and Vermont are chiefly red, green, purple, or variegated. Some slates retain their color for many years, whereas others change in color after exposure to the weather, although such color change may not indicate any deterioration. The color assumed on aging may, in fact, be more attractive than the original.

Slates consist of very stable and enduring minerals, and there are numerous records of high-grade slate roofs that have withstood the weathering of centuries without noticeable deterioration.

STRUCTURAL FEATURES OF SLATE

The most noteworthy structural characteristic of slate, as mentioned previously, is its slaty cleavage. Slates usually possess a second direction of splitting less pronounced than the slaty cleavage; it is known as "sculp" or "grain" and is usually vertical and approximately at right angles to the slaty cleavage. The third direction, in which there is no tendency to split, is known as the "hard way." Another characteristic feature of some slates, notably those of Pennsylvania, is known as "ribbon," which consists of dark bands crossing the slate surfaces. The ribbons represent variations in the original materials as they were laid down in successive beds. They mar the appearance of the slate for certain uses, and some of them contain minerals that are less enduring than the clear stock.

USES

Originally slate was employed almost entirely for roofing; although this is still an important use, many others have been developed. Slate that is worked up into slabs of various sizes and shapes is classed under the general term of mill stock.

Blackboards and school slates constitute an important branch of mill-stock manufacture. Another important division of mill-stock manufacture includes such products as mantles, floor tiles, steps, risers, baseboards, window sills, lavatory slabs, billiard and other table tops, wainscoting, hearths, well caps, vats, sinks, laundry tubs, grave vaults, refrigerator shelves, flour bins, and dough troughs.

Various surface finishes are obtained by the so-called marbleizing process; this consists of repeated painting and baking. A more recent form of surface finish, known as "Struco," consists of spraying or printing the surface with a volatile lacquer. Very beautiful designs are possible for application to various forms of structural products as well as to novelties, such as clocks, inkwells, paperweights, etc.

Slate is also manufactured into slabs for electrical switchboards. Such slate must be low in carbon and in iron-bearing minerals.

Slate is finding wider use for floors and walks; very attractive sidewalks, store entrances, and display-window floors are made of slate slabs of various colors. They may consist of irregularly shaped fragments or of rectangularly sawed slabs of various sizes. A plant was recently established at Poultney, Vt., for the manufacture of standard sizes of slate flooring tile. The tile are cut so accurately that the joints between them are very narrow and are easily cemented. An unusual new use employed by some Tennessee architects in university and church building is a combination of slate with building stones in wall construction.

Slate crushed to granular form is employed very widely in the manufacture of slate-surfaced composition roofing. Red, green, and blue-black or gray granules are manufactured from slates having these natural colors. Experiments are being conducted in the artificial coloring of granules to provide material for the highly colored roofs demanded by many architects and home builders. The chief problem is to procure a fast color that will neither wash out nor fade. Slate in pulverized form, known as slate flour, is used as a filler in paints, road asphalt-surface mixtures, roofing mastic, and various other products.

TECHNOLOGY

During recent years the slate industry has made long strides toward a better technique in quarrying and manufacture. A notable example is the substitution in Pennsylvania of wire saws for channeling machines in making the primary cuts in quarries. This equipment, introduced about four years ago by the Bureau of Mines in cooperation with the National Slate Association and some of the operators, has proved of great advantage in conserving slate, saving time, and reducing production costs. About 30 wire saws are now in use in slate quarries. The wire saw and its operation have been described in some detail in a recent bureau report.[3] Some interest has been shown in extending the use of the wire saw to the cutting of slate blocks in mills.

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[3] Bowles, Oliver, The Wire Saw in Slate Quarrying: Tech. Paper 469, Bureau of Mines, 1930, 31 pp.

Several companies are now operating mills for the manufacture of roofing slate. Some companies have had great success with the mill method of manufacturing roofing slate, whereas others do not regard it with favor.

STUDY OF THE PROPERTIES OF SLATE

Considerable progress is being made toward a more accurate determination of the properties of slate in their relation to use. The National Slate Association and Committee D–16 of the American Society for Testing Materials are sponsoring better classification and more adequate specifications, the latter involving studies of properties and methods of tests. The United States Bureau of Standards and several college laboratories, notably those of Lafayette College, Lehigh University, and Rensselaer Polytechnic Institute, have conducted tests on the physical and chemical properties of various slates and are endeavoring to standardize the methods of testing. The University of Cincinnati is conducting tests on the weathering properties of slates. The Federal Specifications Board is taking active steps toward establishing a standard specification for roofing slate for government use. It is to be expected that these efforts will in time develop a mass of authoritative information that will enable slate producers to classify their materials more definitely and to direct each type to the use for which it is best adapted.

MARKETING PROBLEMS

As may be noted from the table of slate production over a period of years, given on a following page, the industry made rapid strides for the four years following 1922, but for the past three years production has decreased appreciably. The lack of more consistent growth in the industry is due to various causes. It is to be attributed chiefly to the keen competition that slate must meet in every line of production. Various types of roofing are much more widely advertised than slate, and many of them are synthetic products that can be manufactured at low cost. Similarly, slate meets with numerous competitive materials in structural and electrical applications. The recent depression in the blackboard-slate market is due to a recession in school construction. For about 10 years after the war there was great activity in schoolhouse construction to catch up with building programs retarded by the war; that period of activity is, however, now past and such construction has returned to normal.

Another factor that retards progress is the lack of efficient selling and advertising agencies, those sections of the industry that are most lacking in this respect being the least prosperous at the present time. There is, however, evidence of a movement toward bettering this condition through the establishment of joint marketing agencies in some localities to bring about better contacts between producers, distributors, and roofing and setting contractors, thus promoting sales and insuring better service to ultimate consumers. The big problem in all the slate regions is to find a market of sufficient extent to absorb the normal output of the quarries. During 1929 marketing companies and associations exerted a growing influence, particularly in Pennsylvania and Virginia. Sales organizations in Vermont and New York have been effective only in the marketing of structural slate and that used for floors, walks, and walls. Marketing in several districts has been assisted in some degree by improved freight-rate classifications.

UNIFORM COST ACCOUNTING

The desirability of attaining a more accurate knowledge of costs has induced operators to encourage the acceptance of a uniform system of accounting. At the annual meeting of the National Slate Association held in New York in January, 1929, a cost-keeping committee was appointed. The Bureau of Mines working in cooperation with this committee has prepared a cost-keeping system, which has been published as a bureau report.[4] Slate producers should make practical application of this system. A better knowledge of costs will undoubtedly assist operators in working out economics in quarrying and manufacture and should exert a strong influence toward stabilizing prices.

PRODUCTION

The following tables show sales of slate, by uses, from 1920 to 1929. The total quantity and value given for each use are the totals of the reports of the quarrymen (not the selling agents), and the value is that f. o. b. quarry or nearest point of shipment. Some of the mill stock may ultimately be used for purposes other than those reported by the quarrymen.

Slate sold by producers in the United States, 1920–1929, by uses

[Value is at point of shipment]

Year	Roofing slate		Mill stock		Other uses [1] (value)	Total value
	Squares (100 square feet)	Value	Square feet	Value		
1920	396, 230	$3, 524, 658	9, 910, 000	$3, 147, 281	$2, 054, 503	$8, 726, 442
1921	348, 085	3, 197, 745	8, 970, 000	2, 719, 723	1, 404, 538	7, 322, 006
1922	479, 243	4, 069, 761	9, 276, 800	2, 899, 195	2, 207, 828	9, 176, 784
1923	507, 587	4, 582, 535	11, 109, 480	4, 159, 644	3, 334, 445	12, 076, 624
1924	469, 393	4, 626, 614	10, 009, 180	3, 922, 366	3, 227, 036	11, 776, 016
1925	494, 530	5, 084, 945	11, 077, 860	4, 231, 477	3, 258, 904	12, 575, 326
1926	465, 900	5, 079, 087	10, 278, 130	4, 191, 185	3, 082, 495	12, 352, 767
1927	468, 560	4, 949, 940	9, 287, 680	3, 519, 386	2, 911, 410	11, 380, 736
1928	483, 280	5, 411, 332	9, 220, 170	3, 408, 304	2, 652, 655	11, 472, 291
1929	462, 120	4, 920, 766	9, 936, 480	3, 702, 145	2, 622, 267	11, 245, 178

[1] Chiefly slate granules.

In approximating the tonnage for the different slate products given in the table that follows a specific gravity of 2.75 has been used as the basis of calculation and thicknesses ranging from three-sixteenths inch to 2 inches to correspond to the averages for the several products. The calculation is made on the individual lots reported by each producer. The thickness of the individual roofing slates sold—especially in New York and Vermont—has increased greatly in the last few years, owing to the demand for better roofs and for architectural effects. The weights of a square of slate as reported by the quarrymen ranged from 670 to 2,000 pounds.

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[4] Bowles, Oliver, A System of Accounts for the Slate Industry: Repts. of Investigations, Serial 2971, Bureau of Mines, November, 1929, 41 pp.

Roofing slate, mill stock,[1] and slate granules (including slate "flour") sold by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Roofing squares	483, 280	$5, 411, 332	462, 120	$4, 920, 766
Approximate equivalent in short tons	177, 310		178, 500	
Electrical square feet	1, 289, 060	1, 025, 386	1, 461, 110	1, 153, 396
Approximate equivalent in short tons	10, 990		12, 580	
Structural and sanitary square feet	2, 543, 470	1, 034, 818	3, 286, 550	1, 287, 150
Approximate equivalent in short tons	19, 990		24, 730	
Grave vaults and covers square feet	532, 570	136, 836	515, 450	133, 031
Approximate equivalent in short tons	5, 060		4, 700	
Blackboards and bulletin boards square feet	3, 713, 840	1, 079, 452	3, 562, 360	1, 042, 771
Approximate equivalent in short tons	9, 450		9, 280	
Billiard-table tops square feet	293, 360	109, 221	161, 470	65, 426
Approximate equivalent in short tons	2, 550		1, 390	
School slates pieces	1, 584, 820	22, 591	1, 843, 000	20, 371
Approximate equivalent in square feet	847, 870		949, 540	
Approximate equivalent in short tons	740		1, 030	
Flagstones, walk ways, etc square feet	932, 110	184, 184	1, 248, 190	124, 524
Approximate equivalent in short tons	6, 290		8, 920	
Granules and "flour" short tons	413, 980	2, 468, 471	428, 940	2, 497, 743
Total (quantities approximate, in short tons)	646, 360	11, 472, 291	670, 070	11, 245, 178

[1] Mill stock sold, including school slates, was as follows: 1928, 9,220,170 square feet, valued at $3,408,304; 1929, 9,936,480 square feet, valued at $3,702,145.

Slate sold by producers in the United States, 1928 and 1929, by States and uses

State	Operators	Roofing		Mill stock		Other uses (value) [1]	Total value
		Squares (100 square feet)	Value	Square feet	Value		
1928							
Arkansas	1					(2)	(2)
California	1					(2)	(2)
Georgia	1					(2)	(2)
Maine	3	(2)	(2)	(2)	(2)	(2)	$551, 242
Maryland	3	(2)	(2)	(2)	(2)	(2)	187, 830
New York	15	21, 040	$409, 821	1, 300	$1, 040	$641, 502	1, 052, 363
Pennsylvania	39	256, 540	2, 033, 588	7, 914, 110	2, 401, 696	351, 071	4, 786, 355
Tennessee	1					(2)	(2)
Vermont	43	161, 280	2, 423, 830	750, 510	502, 055	1, 056, 043	3, 981, 928
Virginia	6	37, 000	458, 153			(2)	(2)
Undistributed [3]		7, 420	85, 940	554, 250	503, 513	604, 039	912, 573
	113	483, 280	5, 411, 332	9, 220, 170	3, 408, 304	2, 652, 655	11, 472, 291
1929							
Arkansas	1					(2)	(2)
California	2					(2)	(2)
Georgia	1					(2)	(2)
Maine	2	3, 720	38, 316	702, 740	613, 996	1, 315	653, 627
Maryland	3	(2)	(2)			(2)	214, 770
New Jersey	1	(2)	(2)				(2)
New York	22	14, 670	204, 362			634, 169	838, 531
Pennsylvania	38	251, 880	1, 967, 428	8, 011, 080	2, 473, 838	356, 934	4, 798, 200
Vermont	51	151, 810	2, 214, 869	1, 222, 660	614, 311	875, 714	3, 704, 894
Virginia	6	35, 460	434, 628			(2)	(2)
Undistributed [3]		4, 580	61, 163			754, 135	1, 035, 156
	127	462, 120	4, 920, 766	9, 936, 480	3, 702, 145	2, 622, 267	11, 245, 178

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[1] For details see table of general sales above and table on p. 171 for Pennsylvania.
[2] Included under "Undistributed."
[3] Includes output of States entered as "(2)" above.

IMPORTS

Value of slate imported for consumption in the United States, 1920–1929

1920	$4,512	1925	$64,570
1921	2,923	1926	86,681
1922	2,753	1927	78,909
1923	16,881	1928	44,778
1924	32,095	1929	95,073

Value of slate imported into the United States, 1926–1929, by countries [1]

[General imports]

Country	1926	1927	1928	1929
Austria	----------	----------	$5	----------
Belgium	$297	$282	1,067	$1,468
Canada	21	5	1,517	----------
China	68	7	----------	15
Czechoslovakia	16	3	40	187
France	29,465	9,450	11,563	11,748
Germany	9,201	323	107	453
Gibraltar	----------	----------	30	----------
Hong Kong	10	51	15	11
Italy	43,797	30,069	16,910	37,099
Japan	113	178	73	433
Netherlands	3	----------	----------	16,489
Norway	506	2,040	1,201	6,995
Portugal	6,100	9,029	9,076	22,638
Spain	857	----------	----------	1,171
Sweden	----------	----------	----------	954
Switzerland	----------	1,580	----------	----------
United Kingdom	3,143	21,029	2,738	2,866
	93,597	74,046	44,342	102,527

[1] Quantity not recorded.

About 15 per cent of the value of the slate imported in 1929 was represented by roofing slate, of which more than 75 per cent was the value of slates from France. Other roofing slate was reported chiefly from Netherlands, Norway, Belgium, United Kingdom, and Germany. Somewhat more than one-half the value of total imports was for slate in the form of slabs, chiefly from Italy and Portugal but also from Netherlands, Norway, United Kingdom, Japan, Spain, and Czechoslovakia. Some blackboard material was imported from Italy and some school-slate material from Germany. A small part of the total value of the imports was reported as made up of tiles, plaques, and unspecified products. The slate from Netherlands, which represented 16 per cent of the total value in 1929, was chiefly classed as "natural slate." To determine the exact nature of the slate imported is difficult on account of indefinite classification. The countries given in the foregoing table represent the shipping points and do not necessarily indicate the origin of the product. No granules were noted among the imported materials.

TARIFF

Prior to 1913 the duty on imported slates, chimney pieces, mantels, slabs for tables, roofing slates, and all other manufactures of slate, was 20 per cent ad valorem. The act of October, 1913, reduced it to 10 per cent ad valorem; that of September, 1922, raised it to 15 per cent ad valorem; and the act of 1930 raised it to 25 per cent ad valorem.

EXPORTS

Roofing slate exported from the United States, 1920–1929

Year	Number of squares	Value	Year	Number of squares	Value
1920	(1)	$122,105	1925	5,785	$54,130
1921	(1)	101,630	1926	5,621	53,117
1922	11,040	97,811	1927	6,798	80,171
1923	8,462	78,780	1928	12,236	119,187
1924	8,165	77,422	1929	10,376	121,367

[1] Quantity not recorded.

Roofing slate exported from the United States, 1927–1929, by countries

Country	1927		1928		1929	
	Number of squares	Value	Number of squares	Value	Number of squares	Value
Canada	5,714	$70,974	6,642	$79,952	8,277	$102,053
Colombia					36	174
Mexico	92	1,270	85	300	77	352
New Zealand	75	1,354			148	2,318
Panama	38	848	154	1,330	5	25
Philippine Islands	10	83	126	172		
United Kingdom	681	3,691	4,879	34,477	1,372	11,470
West Indies:						
British—						
Bermuda	31	421			5	25
Trinidad and Tobago	66	659	222	1,440	196	1,767
Other	62	243	38	800	49	250
Cuba	29	628	74	659	20	134
Haiti					191	2,799
Virgin Islands of the United States			16	57		
	6,798	80,171	12,236	119,187	10,376	121,367

The following figures for exports of slate other than roofing slate were collected by the Bureau of Mines from shippers of the products named. Of the slate reported in this table all the blackboard material except a small shipment to Alaska was shipped to Canada, as was over 95 per cent of the structural slate, over one-half of the electrical slate, and practically all of the granules. School slates also were shipped to Canada, but India, Netherland East Indies, Australia, and New Zealand took the largest quantities in 1929. South America, West Indies, and Asia furnished markets for electrical slate, and Mexico, Central America, and the Philippine Islands for billiard-table slate. Small shipments of granules to England and Germany were recorded.

Slate other than roofing exported from the United States, 1927–1929, by uses

Use	1927		1928		1929	
	Quantity	Value	Quantity	Value	Quantity	Value
School slates, cases [1]	8,060	$76,333	14,320	$81,075	19,570	$108,135
Electrical slate, square feet	25,550	26,916	23,190	19,102	16,720	18,037
Blackboards, do	142,650	50,120	160,680	63,526	188,720	74,610
Billiard tables, do	55,350	37,341	65,620	45,010	20,150	34,455
Structural, do	13,200	9,100	14,440	7,741	18,390	15,882
Slate granules and "flour", short tons	11,360	67,000	13,990	82,140	14,250	84,185
		266,810		298,594		335,304

Cases weigh from 130 to 165 pounds each average is 135 pounds.

REVIEW BY DISTRICTS

The active slate-producing districts of the United States are the Monson district of Maine; the New York-Vermont district, including Washington County, N. Y., and Rutland County, Vt.; the Lehigh district, including Lehigh and Northampton Counties, Pa., and Sussex County, N. J.; the Peach Bottom district, including Lancaster and York Counties, Pa., and Harford County, Md.; Berks County, Pa.; and the Buckingham County (Arvonia) and Albemarle County districts of Virginia. These districts produce roofing slate and mill stock; some of them also produce roofing granules and slate flour. Roofing granules and flour were also produced in California and Georgia in 1929. A small amount of slate was taken out in Arkansas for assessment work.

Maine.—The slate produced in the Maine district is sold chiefly for electrical work. Lesser amounts of slate from this district are sold for roofing and for structural work. There was a slight decrease in the quantity of roofing slate sold in 1929, compared with 1928, and an increase in the sales of electrical slate. The producing companies in 1929 were The Monson Maine Slate Co. (address, 38 Chauncy Street, Boston, Mass.) and the Portland-Monson Slate Co. (address, 25 Central Wharf, Portland, Me.), both with quarries at Monson.

New York-Vermont.—The New York slate district adjoins that of Vermont, so it is sometimes difficult to determine from the reports of the producers to which State the product should be credited. These two States produce all of the colored slates used for roofing. Red slate is the chief product of the New York quarries, but they also produce, with those of Vermont, the various green, purple, variegated, mottled, and "freak" slates in demand for roofs.

The output of the New York quarries is for granules (red), roofing slate, and slabs for walk ways, flagging, etc. The principal producers of granules are the Advance Industrial Supply Co. (address, 111 West Washington Boulevard, Chicago, Ill.) and the J. B. Preston Co. (Inc.) (address, 122 East Forty-second Street, New York City), Granville; the Staso Milling Co. (address, 332 South Michigan Avenue, Chicago, Ill.), Hampton; and the Sheldon Slate Products Co., Middle Granville. The Advance Industrial Supply Co. and the Sheldon Slate Products Co. also produced roofing slate. Other roofing-slate producers in New York are The John D. Emack Co. (address, 112 South Sixteenth Street, Philadelphia, Pa.), Elbel Slate Co., Robt. R. Lewis, Thomas L. Lewis, John Ritchie, Schubert Bros., and Searles Slate Co., Granville; Geo. Andrus, Wm. Darius, G. H. Hopkins (address, Whitehall), McDonough Slate Co., and McGrath Bros., Middle Granville; and others who operate quarries intermittently and sell their product through dealers or other quarry operators. The chief producers of flagging, walk ways, etc., are The John D. Emack Co., G. H. Hopkins, McDonough Slate Co., and the Sheldon Slate Products Co., with addresses as given above, and Earl & Ritchie (address, Fair Haven, Vt.), Whitehall.

The Vermont quarries produce roofing slate, mill stock, granules, and slate for walks, etc. The colors are in wide variety and combinations of green and purple and are generally classed as green, unfading green, unfading mottled green and purple, weathering green (sea green), purple, variegated, and "freak." There are also black and gray varieties. Most of the granules manufactured are green. Much of the roofing slate produced in Vermont is, as in New York, quarried and shaped by owners of small quarries that are worked at irregular intervals. This slate is generally of unusual color and specially sized and is sold through operators of large quarries or through dealers. On account of the variety of colored slates found in the district much of the roofing slate commands a high price. There was a decrease of nearly 6 per cent in the quantity of roofing slate reported sold in Vermont in 1929 as compared with 1928. Slate for roofing and for mill stock used in structural and sanitary work, for electrical purposes, and in billiard-table tops is produced in Vermont, chiefly by the following firms, many small producers being omitted:

Castleton: The John Jones Slate Co.; mill stock.
Castleton and Poultney: The Penrhyn Slate Co. of Vermont (address, Hydeville); roofing, mill stock.
Fair Haven:
  S. Allen's Sons; roofing, mill stock.
  C. R. Beach; roofing.
  Harvey Bush Slate Co.; roofing.
  Clark-Flanagan (Inc.); roofing, mill stock.
  Durick, Keenan & Co. (Inc.); mill stock.
  Fair Haven Marble & Marbleized Slate Co.; mill stock, roofing.
  Hinchey Consolidated Slate Co.; roofing, mill stock.
  Hydeville Slate Works (address, Hydeville); mill stock.
  Pedro Bros. Slate Co. (address, Poultney); roofing.
  W. H. Pelkey; roofing, mill stock.
Pawlet:
  O'Brien Bros. Slate Co. (Inc.) (address, Granville, N. Y.); roofing.
  Ondawa Slate Co. (address, Granville, N. Y.); roofing.
  Owen W. Owens & Sons (Inc.) (address, Granville, N. Y.); roofing.
  Roberts, Jones & Williams (address, Granville, N. Y.); roofing.
  H. G. Williams Slate Co. (address, Granville, N. Y.); roofing.
Pawlet, Poultney, and Rupert: F. C. Sheldon Slate Co. (address, Granville, N. Y.); roofing.
Pawlet and Wells: Norton Bros. (address, Granville, N. Y.); roofing.
Poultney:
  The Auld & Conger Co. (address, 1920 East Seventy-fifth Street, Cleveland, Ohio); Bush quarries; roofing. Quarries not operated in 1929; sales made from stock.
  Cambrian Slate Co. (address, Granville, N. Y.); roofing.
  Consolidated Slate Corporation of Vermont; roofing.
  El Nido Slate Co.; roofing.
  The John D. Emack Co. (address, 112 South Sixteenth Street, Philadelphia, Pa.); roofing.
  McCarty Slate Co.; roofing.
  Mahar Bros. Slate Co. (Inc.) (address, Fair Haven); roofing, mill stock.
  Mammoth Slate Co.; roofing, mill stock.
  Montvert Slate Co.; roofing.
  New England Slate Co.; roofing.
  Andrew Panda; roofing.
  Red Morris Slate Co.; roofing.
Poultney and West Pawlet: Rising & Nelson Slate Co. (address, West Pawlet); roofing.
Wells:
  Evergreen Slate Co. (address, Granville, N. Y.); roofing.
  R. Brereton Jones Slate Co. (address, Granville, N. Y.); roofing.
  Mettowee Valley Slate Co. (address, Granville, N. Y.); roofing.
  Wm. Morris & Son (address, Granville, N. Y.); roofing.
  Williams Bros. (address, Middle Granville, N. Y.); roofing.
West Pawlet:
  Edwards Bros.; roofing.
  Hughes & Edwards; roofing.
  Jones & Roberts; roofing.
  Patrick Kehoe; roofing.
  Griffith T. Roberts Estate; roofing.

Nearly all of the firms in Vermont that produce mill stock also sell slabs for flagstones, stepping-stones, etc. Vermont produces the greater part of this class of slate. Slate granules and slate flour are produced at Castleton by the Staso Milling Co. (address, 332 South Michigan Avenue, Chicago, Ill.).

Maryland-Pennsylvania.—Production in the Peach Bottom district in Maryland and Pennsylvania was confined to roofing slate and granules in Harford County, Md., and granules in York County, Pa.

Slate for roofing was quarried in Maryland in 1929 at Cardiff, Harford County, by the Peach Bottom Slate Co. of Harford County (address, Delta, Pa.) and the Peerless Slate Co. (address, 119 Federal Street, N. S., Pittsburgh, Pa.). The Staso Milling Co. (address, 332 South Michigan Avenue, Chicago, Ill.) operates a plant for the production of slate granules and flour at Whiteford, Harford County.

The granules from York County, Pa., were produced by The Funkhouser Co. (address, Hagerstown, Md.), near Delta.

Pennsylvania is the largest producer of slate (exclusive of slate granules) in the United States and also produces a greater variety of slate products than any other State, although Maine and Vermont both outrank it in the output of electrical slate. The total value of the slate sold in Pennsylvania by the producers was slightly greater in 1929 than in 1928.

The sales of slate by producers in Pennsylvania, by counties and uses, in 1929 were as follows:

Slate sold by producers in Pennsylvania in 1929, by counties and uses

County	Operators	Roofing slate		Mill stock			
		Squares (100 square feet)	Value	Structural and sanitary[1]		Electrical	
				Square feet	Value	Square feet	Value
Berks, Northampton,[2] and York	3						
Lehigh	9	18,890	$135,000	69,270	$34,221	240,500	$135,771
Northampton	26	232,990	1,832,428	2,943,230	1,101,474	100,030	83,990
	38	251,880	1,967,428	3,012,500	1,135,695	340,530	219,761
Total, 1928	39	256,540	2,033,588	2,756,410	999,766	340,100	211,588

County	Mill stock—Continued				Other (value)[3]	Total value
	Blackboards and bulletin boards		School slates			
	Square feet	Value	Square feet	Value		
Berks, Northampton,[2] and York					$352,402	$352,402
Lehigh	925,120	$193,063	949,540	$20,371		518,426
Northampton	2,637,240	849,708			[4] 59,772	3,927,372
	3,562,360	1,042,771	949,540	20,371	412,174	4,798,200
Total, 1928	3,713,840	1,079,452	847,870	22,591	439,370	4,786,355

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[1] Includes slate for grave covers and vaults.

[2] For roofing granules and "flour."

[3] In 1928 includes 255,890 square feet of billiard-table material, valued at $88,299, and 50,020 tons of granules and "flour," valued at $348,728; in 1929 includes 146,150 square feet of billiard-table material, valued at $55,240, and 58,490 tons of granules and "flour," valued at $352,402.

[4] Exclusive of value of roofing granules and "flour," which is included in first entry above.

The principal slate-quarry operators in Pennsylvania and the classes of slate produced by them are as follows:

Berks County: Lenhartsville—Greenwich Manufacturing Co.; red slate "flour."

The Lehigh district, which includes Lehigh and Northampton Counties, now produces all of the roofing slate and all of the mill stock sold in the State.

Lehigh County: All the slate companies operating in Lehigh County produce both roofing and mill stock. The quarries are in the vicinity of Emerald, Slatedale, and Slatington. The producing companies in 1929 and their addresses were as follows: J. P. Kern Slate Co., Royal Blue Slate Co., and Shenton Slate Co., Slatedale; American Slate Quarries, Blue Mountain Slate Manufacturing Co., Blue Ridge Quarries (Inc.), Cambridge Slate Co., Manhattan Slate Co., and Slatington Slate Co., Slatington.

Northampton County: The quarry operators in Northampton County and their product in 1929 were as follows:

Bangor:
  Bangor Ideal Slate Mining Co.; roofing.
  Bangor Quarry Co. (address, 1920 East Seventy-fifth Street, Cleveland, Ohio); Bangor Union quarry; roofing, mill stock.
  Bangorvein Slate Co.; Bangor Peerless quarry; roofing, mill stock.
  Columbia Bangor Slate Co.; roofing.
  North Bangor Slate Co.; roofing, mill stock.
  Old Bangor Slate Co.; roofing.
  Slate Products Co. (Inc.); roofing, mill stock.
Berlinsville: Amalgamated Slate Quarries Co. (address, Easton); Genuine Washington quarries; roofing, mill stock.
Chapman Quarries: Chapman Slate Co. (address, Bethlehem); roofing.
East Bangor: East Bangor Consolidated Slate Co.; roofing, mill stock.
Edelman: The Hard-Vein Slate Co. (address, Easton); roofing.
Nazareth: Edelman Standard Hardvein Slate Co. (address, Edelman); roofing.
Pen Argyl:
  Albion Vein Slate Co. (address, Bangor); roofing.
  Belmont Slate Co. (address, Bangor); roofing, mill stock.
  Diamond Slate Co. (Inc.); mill stock.
  Doney Slate Co. (Inc.); roofing, mill stock.
  Jackson-Bangor Slate Co.; roofing, mill stock.
  Keenan Structural Slate Co. (address, Bangor); Albion quarry; roofing, mill stock.
  Parsons Bros. Manufacturing Co.; slate "flour."
  Parsons Bros. Slate Co.; roofing, mill stock.
  Stephens-Jackson Co.; Courtney quarry; roofing, mill stock.
  D. Stoddard & Son (address, Bangor); mill stock.
West Bangor: Bangor Fidelity Slate Co. (address, Bangor); roofing, mill stock.
Windgap:
  Bolger-Heller Slate Co.; roofing, mill stock.
  Colonial Slate Co. (address, Bangor); roofing, mill stock.
  Imperial Slate Blackboard Co.; roofing, mill stock.
  Phoenix Slate Co.; roofing, mill stock.

Virginia.—Slate was quarried in Virginia in 1929 by the following companies:

Albemarle County:
  Esmont—Blue Ridge Slate Corporation (address, Charlottesville); Flint Arrow and Dutch Gap quarries; roofing, granules.
  Monticello—Monticello Slate Co. (address, care of Williams-Arvonia Slate Corporation, Richmond); roofing.

Buckingham County:
  Arvonia—
    Arvonia-Buckingham Slate Co. (Inc.) (address, Richmond); roofing.
    Williams Slate Co. (Inc.); Big Quarry; roofing.
  Ore Bank—
    Le Sueur-Richmond Slate Corporation; roofing.
    Pierce Slate Co.; roofing.

Other States.—A small amount of slate used for flagging or walk ways was taken from the slate deposits near Norman, Montgomery County, Ark., operated by E. C. Bird, of Little Rock. The slate was taken out for assessment work; distance of haul to market is said to be the principal reason against the more active development of the quarries.

In 1929 The Pacific Minerals Co. (Ltd.) (address, Richmond) operated the Chili Bar slate quarry at Placerville, Eldorado County, Calif., for slate granules, and John L. Witney (Inc.), Jamestown, quarried slate in Tuolumne County for roofing granules.

Slate granules (green) and ground slate for use as a fertilizer filler were produced at Fair Mount, Ga., in 1929 by The Funkhouser Co. (address, Hagerstown, Md.).

The slate quarries near La Fayette, Sussex County, N. J., are operated in beds that are geologically and geographically continuous with the slate beds in Lehigh and Northampton Counties, Pa. These quarries were reopened in 1928 and operated in 1929 for roofing slate by the Lafayette Slate Mining Corporation (address, Port Chester, N. Y.).

SHIPMENTS

The localization of slate deposits in the most thickly populated part of the United States makes transportation to markets in other areas where cities and towns are growing up a matter of considerable importance to the slate trade. Transportation and freight rates have long been a retarding factor in the slate industry. The total quantity of slate quarried annually is small compared with that of many other mineral products, and no one company has a large output. To facilitate marketing the large quarry companies and joint selling agencies act as distributors for many of the quarries as well as buyers for the slate trade. As a result, many quarry operators have no record of the ultimate destination of their slate. Others refuse to take the trouble to compile the statements which necessarily take time but would seem to be of material value in finding new markets for their slate and in keeping track of fluctuations in their regular markets. Still others object to giving figures for fear of revealing their market. All individual figures submitted are kept strictly in confidence and are used only for arriving at totals and averages. More complete cooperation of slate producers and selling agencies would enable the bureau to conduct marketing studies that should be of advantage to the industry.

The statistics collected by the Bureau of Mines are obtained primarily from the quarrymen rather than from dealers and jobbers, and the figures showing the distribution of the sales of slate have not been satisfactory. Dealers have, however, cooperated with the Bureau of Mines by furnishing statements of the distribution of their sales for 1929. In New York and Vermont the larger producing companies as well as jobbers and dealers act as distributing agents.

The general trend of shipments of slate products by destination territories, however, is shown in the following table of shipments, the incompleteness of which is largely due to the disinclination of the producers and dealers to supply this information.

Distribution of slate products in 1929, by destinations

Destination	Roofing (squares)	Structural and sanitary (square feet)	Floors and walks (square feet)	Vaults and covers (square feet)	Blackboards and bulletin boards (square feet)	Billiard-table tops (square feet)	Electrical (square feet)	Granules (short tons)	"Flour" (short tons)
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	29, 051	219, 880	116, 851	107, 406	188, 609	8, 287	154, 909	30, 173	5, 368
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	120, 363	941, 531	466, 586	260, 723	1, 082, 752	28, 283	284, 584	93, 065	18, 361
Illinois, Indiana, Michigan, Ohio	15, 678	462, 197	77, 445	40, 509	570, 672	18, 359	96, 594	164, 004	7, 152
Florida, Georgia, North Carolina, South Carolina, Virginia	154	26, 031	6, 321	19, 400	133, 610	--------	303	18, 632	5
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	7, 358	26, 916	3, 794	81	98, 090	466	3, 897	17, 501	510
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	6, 721	60, 705	10, 481	7, 406	375, 738	28, 980	11, 023	12, 924	60
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	3, 295	10, 182	57	--------	232, 654	408	20, 429	9, 731	--------
Total distribution reported	182, 620	[1] 1, 747, 442	[1] 681, 535	435, 525	2, 682, 125	84, 783	571, 739	346, 030	31, 456
Total sales	462, 120	3, 286, 550	1,248,190	515, 450	3, 562, 360	161, 470	1, 461, 110	395, 830	33, 110

[1] Some slate classed as structural included under "Floors and walks."

SULPHUR AND PYRITES[1]

By ROBERT H. RIDGWAY[2]

SUMMARY

The position of the United States as the major factor in world production of sulphur was maintained in 1929. The year was characterized by record production and shipments, a steadily maintained price, and a reduction of stocks. Exploration by geophysical methods and by drilling in the Gulf coast region continued, new prospects being investigated and some new discoveries being reported during the year. The consumption of native sulphur and the production and importation of pyrites increased substantially.

Spain continued to be the largest factor in the world's pyrites industry, with Norway, Italy, and Japan increasing their output. Increased activity in pyrites production is also taking place in the United States, Yugoslavia, and Canada. Processes for the recovery of the sulphur content of pyrites, as sulphurous gases or as elemental sulphur, are being developed in the hope of utilizing more completely the iron and sulphur contained in pyrites.

For the United States the situation may be summarized as follows: Compared with 1928, shipments of domestic sulphur increased 17 per cent to 2,437,238 long tons in 1929, whereas production increased 19 per cent to 2,362,389 tons, both record figures for the industry; imports of "sulphur and sulphur ore" amounted to less than 1,200 long tons, whereas exports of crude sulphur increased to a new record of 855,183 long tons and were equivalent to more than half the shipments for domestic use. There was a substantial increase in the consumption of sulphur in the United States, due largely to increases in quantities used in the heavy chemicals, fertilizer, and wood-pulp industries. The production of pyrites amounted to 333,465 long tons in 1929, an increase of 7 per cent, and imports amounted to 514,336 long tons, an increase of 13 per cent.

SULPHUR

DOMESTIC PRODUCTION

The production of sulphur in the United States reached a new high record in 1929, when 2,362,389 long tons was produced. This output represents an increase of 380,516 tons, or 19 per cent, over 1928 and an increase of 250,771 tons, or 12 per cent, over 1927, the previous record year. Not only was 1929 a record year in production but shipments amounted to 2,437,238 tons, valued at about $43,800,000, an increase from 2,082,924 tons, valued at about $37,500,000, in 1928, the previous record year in quantity.

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[1] Work on manuscript completed July, 1930.

[2] Figures on domestic production compiled by H. M. Meyer, and those on imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

Stocks on hand at the mines decreased about 75,000 long tons in 1929, but exceeded 1,900,000 tons at the end of the year.

The average price for sulphur throughout the year, as quoted by the trade journals, was $18 a long ton f. o. b. mines. Open prices were $1 to $3 a ton higher, and prices for sulphur exported were given as $22 a long ton f. a. s. Atlantic ports.

The following table shows the progress of American sulphur production from 1910 to 1929:

Sulphur produced and shipped in the United States, 1910–1929

Year	Produced (long tons)	Shipped		Year	Produced (long tons)	Shipped	
		Long tons	Approximate value			Long tons	Approximate value
1910	247, 060	250, 919	$4, 522, 000	1920	1, 255, 249	1, 517, 625	$30, 000, 000
1911	205, 066	253, 795	4, 573, 000	1921	1, 879, 150	954, 344	17, 000, 000
1912	787, 735	305, 390	5, 289, 000	1922	1, 830, 942	1, 343, 624	22, 000, 000
1913	491, 080	319, 333	5, 617, 000	1923	2, 036, 097	1, 618, 841	26, 000, 000
1914	417, 690	341, 985	6, 214, 000	1924	1, 220, 561	1, 537, 345	25, 000, 000
1915	520, 582	293, 803	4, 959, 000	1925	1, 409, 262	1, 858, 003	29, 000, 000
1916	649, 683	766, 835	12, 246, 000	1926	1, 890, 027	2, 072, 657	37, 300, 000
1917	1, 134, 412	1, 120, 378	23, 987, 000	1927	2, 111, 618	2, 072, 109	38, 300, 000
1918	1, 353, 525	1, 266, 709	27, 868, 000	1928	1, 981, 873	2, 082, 924	37, 500, 000
1919	1, 190, 575	678, 257	10, 252, 000	1929	2, 362, 389	2, 437, 238	43, 800, 000

Texas continued to be by far the largest producer of sulphur in the United States, contributing more than 99.9 per cent of both total production and shipments in 1929. The remainder of the production and shipments in 1929 came from two small operations, one each in Nevada and Utah. No shipments were reported for 1929 from Louisiana. The Union Sulphur Co., formerly the only operator in Louisiana, suspended mining operations in 1924 but continued to ship from stocks; the stocks were exhausted in 1928.

The following table shows the sulphur-mining operations in the United States in 1929:

Sulphur mines operating in the United States in 1929

Operating company	Name of mine	Location of mine
Texas Gulf Sulphur Co	Big Hill Dome	Gulf, Matagorda County, Tex.
Do	Boling Dome	Newgulf, Wharton County, Tex.
Freeport Sulphur Co	Bryan Mound	Freeport, Brazoria County, Tex.
Do	Hoskins Mound	Do.
Union Sulphur Co	Boling Dome	Boling, Wharton County, Tex.
Duval-Texas Sulphur Co	Palangana Dome	Benavides, Duval County, Tex.
Humboldt Sulphur Co		Sulphur, Humboldt County, Nev.
Utah Sulphur Industries		Sulphurdale, Beaver County, Utah.

TEXAS

Texas Gulf Sulphur Co.—During 1929 production was made, as in previous years, at Gulf, Matagorda County, Tex., by the Texas Gulf Sulphur Co.

Probably the most important event in the American sulphur industry during 1929 was the bringing into production of the Texas Gulf Sulphur Co. property on Boling Dome, which lies in a densely wooded area adjacent to the San Bernard River in the southeast corner of Wharton County, Tex. The dome is one of the geologic structures characteristic of the Gulf coast region and is probably the largest salt dome ever found, being more than 4 miles long in a north and south direction and about 3 miles wide, as determined by geophysical methods. The extensive sulphur deposit is located in a cap rock which overlies a salt plug and is overlain by more than 700 feet of unconsolidated sediments and cap rock. Drilling has determined as closely as possible the extent and approximate outline of the deposit. The reserves are said to be large, the dome being estimated to contain several times as much sulphur as the deposit in the Big Hill Dome at Gulf, which was estimated at more than 11,000,000 tons of sulphur.

The sulphur is "mined" by the Frasch process, which was developed on similar properties in this region. The large volume of water required for the extraction of sulphur by this method is obtained from the San Bernard River. The pumping plant has four motor-driven centrifugal pump units of 10,000 gallons per minute capacity each and capable of working against a 65-foot head. The pumping capacity is actually much in excess of plant requirements to take advantage of the seasonal variation in the supply of water. Ample facilities for storing water have been provided in the form of a reservoir 262 acres in extent and capable of holding 750,000,000 gallons. Part of the water required for operation is converted into steam, which is then used to run the pumps, generators, etc., to superheat the remaining water required for extraction of the sulphur, and to supply the steam lines used to keep the sulphur in a molten state until it flows into the storage vats.

The power house is 361 feet long and 112 feet wide. The boiler room is 85 feet high and is equipped with five 1,500-horsepower boilers of the water-tube type, which may be operated continuously at 200 per cent of rating. In addition to the boilers the power house is equipped with the necessary hot-water heaters, air compressors, pumps, and electric generators required for plant and town-site purposes. All water for boiler feed and for the mine is treated in the Cochrane hot-process plant, which has a capacity of 280,000 gallons of water per hour.

Natural gas is used to generate the steam, but the boilers are so equipped that fuel oil may be burned, the design being such that the feed may be switched from gas to oil or from oil to gas in a few minutes. A supply of fuel oil is kept for emergency operation in a tank of 80,000 barrels capacity. In addition, the plant is so designed that with slight adaptation it can be operated on lignite. The burned gases are exhausted through a 330-foot stack, which has an inside diameter of 18 feet at the top. The plant was originally built with foundations for five additional boilers and another stack to permit doubling the plant capacity; early in 1930 the installation of the additional equipment was begun.

The large quantity of water pumped underground to melt the sulphur eventually requires an outlet. The removal of this water is known as bleeding, and the so-called "bleed water" is removed through wells on the edge of the operating area after it has given up the bulk of its heat. Because of the impurities it has absorbed in passing through the formations the bleed water is unfit for reuse in the plant and can not be discharged into near-by fresh-water streams.

It is therefore aerated to remove hydrogen sulphide, treated chemically to remove other impurities, and then conducted through a ditch 20 miles long to tidewater. The plant is connected by rail with the Gulf, Colorado & Santa Fe Railway near Magnet and with the Galveston, Harrisburg & San Antonio Railway (Southern Pacific) at Newgulf Junction near the station of Boling.

Production of sulphur from this dome was begun by the Texas Gulf Sulphur Co. in the latter part of March, 1929, and by the end of the year probably in excess of 300,000 long tons had been produced. There was a small production in 1928 and 1929 from certain tracts on the dome by the Union Sulphur Co., which erected a small plant and drilled a few wells. Such production came from leases in which the Union Sulphur Co. and the Texas Gulf Sulphur Co. each had an interest.

The Long Point salt dome in Fort Bend County, Tex., was discovered by the torsion balance after 1924, and has given evidence of containing a valuable deposit of sulphur. The Texas Gulf Sulphur Co. has acquired all the sulphur-mining rights of the Gulf Production Co. and has been drilling the deposit to determine the extent of the ore body. A sulphur-mining plant is being moved to this property from Big Creek Dome, with the expectation of mining sulphur on a small scale.

Freeport Sulphur Co.—During 1929 production was made at Bryan Mound and Hoskins Mound, Brazoria County, as in previous years.

Duval-Texas Sulphur Co.—The plant of the Duval-Texas Sulphur Co., which started producing in November, 1928, continued to operate throughout 1929, but on a much smaller scale than the other mines in Texas. The company is obtaining sulphur from Palangana Dome, in the east central part of Duval County, about 6 miles north of Benavides, Tex.

Palangana has the characteristic structure of the domes in this district. The salt core is approximately circular in outline with a diameter of 11,000 feet and has a flat top and very steep flanks. A cap rock covers the top of the plug and extends well down the flanks, where the lateral sediments dip steeply away from the salt core. The sulphur-bearing stratum is generally found at depths of 400 to 500 feet and is thin and rich.

Unlike most other salt domes of the Gulf coast region the surficial expression of this dome is a circular ring of low hills surrounding a central basin. The diameter of the floor of the basin is 8,000 feet, while the diameter of the ring of hills which rise 50 to 80 feet above the floor of the basin is 15,000 feet. Little is known of the reserves of this property, as it has not been fully drilled, but recent estimates indicate between 500,000 and 1,000,000 tons of sulphur.

The sulphur is extracted by the Frasch process, and the water necessary for operation is obtained from wells in the vicinity and requires no treatment. There are no large surface reservoirs, such as are characteristic of similar operations elsewhere, as the nature of the ground will not permit storage of water. Tanks have been constructed which contain a 24-hour supply of water. Natural gas, which is later burned in the boilers, is used expansively in the pumps which supply water to the plant. The power plant originally consisted of eight 150-horsepower boilers, with the necessary pumps and equipment for "mining" the sulphur. In 1929 two 500-horsepower Sterling-type boilers were installed and are now carrying most of the load.

The mine is connected by a branch line 2½ miles long with the Texas Mexican Railway, which runs to Corpus Christi, where facilities for loading ships are being provided. The plant was producing about 150 tons of sulphur daily at the end of 1929.

Miscellaneous.—Activities in the field of geophysical prospecting in the search for salt domes continued in the Gulf coast region throughout 1929. While the search for these domes is primarily to locate accumulations of oil, each dome is a potential sulphur ore body until drilling proves otherwise.

A sulphur deposit has been found on the Nash salt dome in the southeastern part of Fort Bend County but it is too deep to be mined profitably at present. The discovery of this dome is credited to the torsion balance.

LOUISIANA

A new discovery of sulphur in Louisiana was reported during the year by the Jefferson Lake Oil Co. while drilling for oil on Jefferson Island salt dome in Iberia Parish, 8 miles southwest of New Iberia, La. It was reported that more than 200 feet of sulphur rock was found at a depth of about 600 feet. Geophysical surveys with the seismograph and torsion balance indicate a potential area of 600 to 700 acres of thick cap rock.

During the year the dome at Belle Isle, La., was prospected for sulphur and dismissed from further consideration as a commercial sulphur deposit.

NEVADA

The Humboldt Sulphur Co. is producing sulphur from a surface deposit at Sulphur, Humboldt County, Nev. Sulphur is recovered from the ore by flotation and by refining the flotation concentrates, which contain about 77 per cent of sulphur. The concentrates, which contain about 18 per cent of moisture, are heated in a retort in the presence of superheated water and agitated by the admission of steam to the bottom of the retort. The sulphur collects in the bottom and is drawn off through specially constructed valves. The product of the refining operation assays better than 99.6 per cent of sulphur and is free from oil. The operation of the plant has been more fully described by Hazen.[3]

UTAH

The Utah Sulphur Industries is producing sulphur at Sulphurdale, Beaver County, Utah, from sulphur tailings left from early Mormon operations. These run 25 per cent sulphur and are the rejections from the sorting of lump sulphur which the early operators conducted in the crater of an old volcano. Below the accumulation of sulphur rejects from these early operations is a considerable deposit of sulphur in place which may be mined by open-cut methods. Sulphur springs are still active in the crater. The sulphur is recovered from the ore by flotation and is either sold as sulphur concentrates or further refined into various grades of sulphur.

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[3] Hazen, H. L., Recovering Sulphur from a Nevada Surface Deposit: Eng. and Min. Jour., vol. 127, No. 21, May 25, 1929, pp. 830–831; Recovery of Sulphur from a Surface Deposit: Min. Jour. (Ariz.), vol. 13, No. 2, Nov. 15, 1929, pp. 7–8, 56–58.

CALIFORNIA

The Pacific Sulphur Corporation is engaged in developing a sulphur deposit in the Cucomongo district in the Last Chance Range in Inyo County, Calif. The property is to be connected by a branch railroad with the Southern Pacific at Owens Lake, Calif.

IMPORTS AND EXPORTS

The imports of sulphur into the United States reached a peak in 1903, when nearly 189,000 long tons was imported, but with the rapid increase in American production the imports have declined and since 1917 have been of little consequence. In 1929, 1,163 long tons of "sulphur and sulphur ore," valued at $6,616, was imported.

The export business in American sulphur was started in 1904, when a cargo of 3,000 tons was shipped from Louisiana. Since then there has been a steady increase until now the annual export is more than 200 times that figure. Increased industrial activity throughout the world caused American exports of sulphur to reach a new peak in 1929, when they amounted to 855,183 long tons, valued at $17,628,813, compared with 685,051 tons, valued at $14,345,075, in 1928, and 789,274 tons, valued at $16,254,227, in 1927, the previous record year.

The following table shows the crude sulphur imported into and exported from the United States from 1910 to 1929:

Crude sulphur imported into and exported from the United States, 1910–1929

Year	Imports for consumption		Exports		Year	Imports for consumption		Exports	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1910	28,656	$496,073	30,742	$552,941	1920	44	$1,722	477,450	$8,994,350
1911	24,200	434,796	28,103	545,420	1921	4	226	285,762	4,524,768
1912	26,885	494,778	57,736	1,076,414	1922	[1] 167	6,453	485,664	7,095,628
1913	15,122	286,209	89,221	1,599,761	1923	[2] 465	21,535	472,525	7,105,260
1914	23,610	398,984	98,163	1,807,324	1924	[2] 1,005	40,293	482,114	7,792,854
1915	24,647	405,990	37,312	724,679	1925	[2] 100	4,411	629,401	11,000,235
1916	21,289	358,416	128,755	2,505,857	1926	[2] 48	1,052	576,966	10,918,394
1917	973	20,176	152,736	3,500,819	1927	[2] 3,384	34,487	789,274	16,254,227
1918	55	1,692	131,092	3,626,638	1928	[2] 4,787	21,320	685,051	14,345,075
1919	77	1,997	224,712	6,325,552	1929	[2] 1,163	6,616	855,183	17,628,813

[1] Composed of 130 tons of "crude sulphur," imported Jan. 1 to Sept. 21, and 37 tons of "sulphur and sulphur ore," imported Sept. 22 to Dec. 31.

[2] Classified as "sulphur and sulphur ore."

In addition to brimstone or crude sulphur the United States exports refined products. Exports of refined, sublimed, and flowers of sulphur decreased from 44,536,508 pounds, valued at $706,766, in 1928 to 39,564,975 pounds, valued at $649,240, in 1929. The average value in 1929 was 1.64 cents a pound, or about $36.75 a long ton.

Canada was again the largest importer of American crude sulphur, taking 200,012 long tons in 1929 (23.4 per cent of total exported); Germany was again second, with 169,474 tons (19.8 per cent); France was again third, with 136,732 tons (16 per cent); and Australia was again fourth, with 104,538 tons (12. 2 per cent). These four countries received more than 71 per cent of the total exports of American brimstone.

Germany was again the best customer for American refined sulphur, taking 10,114,889 pounds in 1929, or more than 25 per cent of the total exported. Canada was again second, with 7,818,689 pounds, or approximately 20 per cent, and was followed by Australia, United Kingdom, Mexico, and Brazil.

The following table of exports for 1928 and 1929 shows an increased demand by all of the larger consumers of American crude sulphur. Canada's imports of American crude increased 40,348 tons, or 25 per cent, over those in 1928. Most of the sulphur imported into Canada is used in the manufacture of sulphite wood pulp. In 1927 the sulphur consumed in this industry in Canada amounted to 130,755 long tons, or nearly 80 per cent of the imports for that year. There was a good demand in 1929 for high-grade sulphite paper. Much of the sulphur exported to Germany is reexported, largely to the Scandinavian countries; most of the remainder is used in the manufacture of rubber tires, pulp and paper, dyestuffs, gunpowder, matches, etc. Large increases are also noted in exports of crude sulphur to France, Australia, New Zealand, and Union of South Africa.

Sulphur exported from the United States, 1928 and 1929, by destinations

Destination	Sulphur or brimstone		Refined, sublimed, and flowers of	
	Long tons	Value	Pounds	Value
1928				
North America:				
Canada	159, 664	$2, 897, 730	7, 562, 023	$140, 604
Central America	126	3, 690	352, 299	8, 887
Mexico	14, 829	317, 192	1, 479, 211	31, 305
Newfoundland and Labrador	7, 751	148, 448	44, 685	971
West Indies and Bermuda	3, 022	42, 907	171, 124	7, 439
	185, 392	3, 409, 967	9, 609, 342	189, 206
South America:				
Argentina	8, 680	182, 280	1, 200	39
Brazil	5, 359	122, 759	2, 374, 781	45, 424
Colombia			120, 754	3, 906
Uruguay			2, 239, 980	31, 164
Other	161	4, 131	289, 492	5, 311
	14, 200	309, 170	5, 026, 207	85, 844
Europe:				
Belgium	10, 970	243, 791	2, 662, 213	39, 067
Finland	1	37		
France	109, 348	2, 408, 898	130, 900	2, 006
Germany	125, 659	2, 847, 969	18, 025, 199	245, 157
Netherlands	48, 928	1, 103, 985	922, 112	14, 139
Spain	11, 098	243, 677		
United Kingdom	44, 098	924, 155	1, 958, 846	28, 522
Other	4, 750	95, 000	2, 351, 675	32, 882
	354, 852	7, 867, 512	26, 050, 945	361, 773
Asia	5, 000	100, 000	599, 941	9, 687
Africa:				
Algeria and Tunisia	4, 428	98, 213		
Mozambique	1, 800	41, 400	25, 000	371
Union of South Africa	11, 078	243, 716	392, 928	6, 382
	17, 306	383, 329	417, 928	6, 753

Sulphur exported from the United States, 1928 and 1929, by destinations—Contd.

Destination	Sulphur or brimstone		Refined, sublimed, and flowers of	
	Long tons	Value	Pounds	Value
1928—Continued				
Oceania:				
Australia	85, 500	$1, 799, 641	2, 422, 835	$43, 789
New Zealand	22, 801	475, 456	409, 310	9, 714
	108, 301	2, 275, 097	2, 832, 145	53, 503
	685, 051	14, 345, 075	44, 536, 508	706, 766
1929				
North America:				
Canada	200, 012	3, 676, 034	7, 818, 689	154, 529
Central America	149	4, 710	311, 606	8, 521
Mexico	13, 334	278, 802	2, 330, 020	49, 351
Newfoundland and Labrador	8, 452	158, 076	3, 323	88
West Indies and Bermuda	4, 000	88, 000	1, 274, 341	31, 497
	225, 947	4, 205, 622	11, 737, 979	243, 986
South America:				
Argentina	4, 200	88, 200	1, 200	23
Brazil	5, 610	124, 880	2, 205, 652	33, 150
Colombia	----------	----------	147, 121	3, 962
Uruguay	----------	----------	1, 791, 960	23, 454
Other	64	1, 883	272, 218	5, 996
	9, 874	214, 963	4, 418, 151	66, 585
Europe:				
Belgium	3, 309	73, 320	1, 098, 419	15, 252
Finland	4, 353	108, 822	----------	----------
France	136, 732	2, 892, 030	289, 200	4, 341
Germany	169, 474	3, 792, 254	10, 114, 889	133, 325
Netherlands	50, 707	1, 133, 659	649, 787	8, 481
Spain	16, 475	333, 924	----------	----------
United Kingdom	43, 856	945, 264	2, 889, 167	43, 150
Other	----------	----------	2, 825, 306	41, 477
	424, 906	9, 279, 273	17, 866, 768	246, 026
Asia	1, 950	41, 925	1, 108, 515	16, 370
Africa:				
Algeria and Tunisia	6, 604	135, 378	----------	----------
Mozambique	10, 000	254, 500	34, 500	514
Other Portuguese Africa	10, 416	197, 488	----------	----------
Union of South Africa	23, 900	495, 700	229, 455	3, 473
	50, 920	1, 083, 066	263, 955	3, 987
Oceania:				
Australia	104, 538	2, 067, 125	3, 684, 423	57, 911
French Oceania	----------	----------	600	30
New Zealand	37, 048	736, 839	484, 584	14, 345
	141, 586	2, 803, 964	4, 169, 607	72, 286
	855, 183	17, 628, 813	39, 564, 975	649, 240

CONSUMPTION

APPARENT CONSUMPTION OF PRIMARY SULPHUR

The production of sulphuric acid is considered a valuable index of the trend of the industrial activity of a country. In the United States about 70 per cent of the acid produced is made from sulphur. Therefore 1929, a banner year industrially, would be expected to show an increase in the consumption of sulphur, and such increase may be estimated to be 182,777 long tons—from 1,382,778 tons in 1928 to 1,565,555 tons in 1929.

Considering the stocks in consumers' hands to be small and constant, the trend of sulphur consumption in the United States may be shown as follows for the last quinquennial period.

Apparent consumption of sulphur in the United States, 1925–1929, in long tons

	1925	1926	1927	1928	1929
Shipments	1,858,003	2,072,657	2,072,109	2,082,924	2,437,238
Imports	100	48	3,384	4,787	1,163
	1,858,103	2,072,705	2,075,493	2,087,711	2,438,401
Exports (crude)	629,401	576,966	789,274	685,051	855,183
Exports (refined)	2,849	5,358	14,026	19,882	17,663
	632,250	582,324	803,300	704,933	872,846
Apparent consumption	1,225,853	1,490,381	1,272,193	1,382,778	1,565,555

CONSUMPTION BY USES

The use of sulphur in the various domestic industries has been estimated for 1927, 1928, and 1929 by Chemical and Metallurgical Engineering, as follows:

Sulphur consumed in the United States, 1927–1929, by uses, in long tons

Use	1927	1928	1929
Heavy chemicals	490,000	520,000	560,000
Fertilizer and insecticides	300,000	345,000	415,000
Pulp and paper	260,000	250,000	265,000
Explosives	65,000	60,000	67,000
Dyes and coal tar products	40,000	42,000	47,000
Rubber	35,000	40,000	43,000
Electrochemicals	20,000	21,000	23,000
Fine chemicals	13,000	14,000	15,000
Paint and varnish	5,000	5,000	5,000
Food products	3,000	5,000	5,000
Petroleum products	1,000	1,000	----------
Miscellaneous	118,000	123,000	136,700
	1,350,000	1,426,000	1,581,700

According to the foregoing figures, increased amounts of sulphur were used in all the major consuming industries, with fertilizers and insecticides showing the largest increase. It will be noted with special interest that the amount consumed in the pulp and paper industry showed an increase over the figures for 1928 and 1927.

The production of sulphuric acid, the chief use of sulphur in the United States, not only enjoyed its best year since the war but exceeded the biggest war year, 1918. The following table shows the estimated distribution of the consumption of sulphuric acid by industries for 1927, 1928, and 1929, as given by Chemical and Metallurgical Engineering.

Sulphuric acid (expressed as 50° B.) consumed in the United States, 1927–1929, by industries, in short tons

Industry	1927	1928	1929	Industry	1927	1928	1929
Fertilizer	2,135,000	2,300,000	2,360,000	Paints and pigments	210,000	210,000	215,000
Petroleum refining	1,250,000	1,350,000	1,570,000	Explosives	183,000	170,000	195,000
Chemicals	725,000	745,000	820,000	Textiles	135,000	130,000	85,000
Coal products	732,000	740,000	820,000	Miscellaneous	280,000	285,000	465,000
Iron and steel	685,000	695,000	770,000				
Other metallurgical	600,000	600,000	625,000		6,935,000	7,225,000	7,925,000

Figures for the production of sulphuric acid as a by-product at the smelting plants in 1927, 1928, and 1929 follow. This table gives the output at both copper and zinc plants, which constitutes practically all the by-product acid produced in the United States. The figures also include the sulphuric acid made from the pyrites concentrates in Tennessee and Wisconsin.

By-product sulphuric acid (expressed as 60° B.) produced at copper and zinc plants in the United States, 1927–1929, in short tons

	1927	1928	1929
Copper plants	452, 855	581, 731	612, 824
Zinc plants	588, 544	558, 537	627, 018
	1, 041, 399	1, 140, 268	1, 239, 842

SUBSTITUTES FOR SULPHUR

Pyrites has long been a competitor of sulphur for use in the manufacture of sulphuric acid and to a lesser extent in the manufacture of pulp and paper. In the United States about 70 per cent of the sulphuric acid produced is made from sulphur and the remainder from iron pyrites and by-product gases from zinc and copper smelter operations. Recent developments in the contact sulphuric acid process may result in increased production of high-strength acids from smelter gases such as are now being wasted because of their impurities and low concentration of SO_2.

Outside the United States, pyrites is the most important source of sulphur dioxide for the manufacture of acid. In Great Britain sulphuric acid produced in 1928 was obtained from the following materials: Pyrites, 44 per cent; spent oxide, 25 per cent; sulphur, 21 per cent; and zinc concentrates, 10 per cent. Recently the use of pyrites in the manufacture of sulphuric acid has decreased due to increased use of sulphur and by-product smelter gases. In the past a considerable amount of sulphur was produced in Great Britain from the alkali waste in the Leblanc process and as spent oxide in the purification of coal gas. The Leblanc process, however, is becoming less important owing to developments in the electrolytic process. In Germany 90 per cent of the sulphuric acid produced is made from pyrites and zinc blende. Some European manufacturers are turning to sulphates (particularly gypsum) as substitutes for both sulphur and pyrites in the manufacture of sulphuric acid. The Bayer factory at Leverkusen is said to have a yearly capacity of 40,000 to 50,000 tons of sulphuric acid from calcium sulphate and to contemplate further extensions. The Bayer process involves the heating of gypsum, clay, and coal with additions of sand and slag; the sulphur dioxide gases evolved are purified and oxidized to sulphuric acid. Molitor[4] has described various methods of utilizing calcium sulphate as a source of sulphuric acid. German economists are urging the use of gypsum as a source of sulphur because of abundant local supplies. France, having practically no sulphur and inadequate supplies of pyrites, is also turning to gypsum. A new plant manufacturing sulphuric acid from gypsum is to be installed at Saint-Chamas. France is also planning the recovery of sulphur at various coke ovens, blast furnaces, and gas plants.

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[4] Molitor, Heinrich, Die Nutzbarmachung der Gipsschwefelsäure: Chem. Ztg., vol. 51, No. 35, May 4, 1927, pp. 324–332, 370–373.

Although sulphuric acid is considered the basis of the chemical industry in the United States and the production has grown tremendously in nearly all countries there have been developed, especially in Germany, sulphuric acid substitutes and substitute processes which are characterized by an increasing elimination of sulphuric acid in the chemical industry. Sulphate of ammonia is now produced from gypsum and anhydrite by the Bayer process; phosphate fertilizers are being manufactured electrically; and sodium sulphate is being made from waste magnesium sulphate. In Canada attempts are being made to substitute pyrites for sulphur in the manufacture of sulphite wood pulp which requires about 280 pounds of sulphur for every ton of sulphite pulp produced. Pyrites may be used in this industry, but the difficulties experienced in obtaining an even flow of clean SO_2 gas have retarded its use to date. One of the recent developments is the invention of a pyrites burner by Horace Freeman of Shawinigan Falls, Province of Quebec. By this method, pyrites is conveyed by suction, dried, and burned in suspension as a powdered fuel. The sulphur dioxide is then treated and washed to free it from dust and sulphur trioxide before entering the limestone towers for the production of digester liquors. By sintering the iron oxide resulting from the pyrites burning a marketable product is obtained which can be utilized in the blast furnace. The heat generated in the burning is recovered in the form of high-pressure steam, the utilization of which more than pays for all operating costs. The Canada Power & Paper Co. has already built at the St. Maurice plant a commercial-size unit having a rated capacity of 20 tons of pyrites a day.

Canada's base-metal sulphide ores contain a high percentage of pyrites which has to be separated from them in producing a high-grade concentrate of the more valuable minerals. By selective flotation a pyrite concentrate rich in sulphur can be made from the tailings. Increased quantities of fine pyrites will be made available with the rapidly broadening application of flotation to the treatment of sulphide ores. Large deposits of such ores are now being developed in various places in Canada. By-product gases from smelter operations are being utilized in the manufacture of sulphuric acid; new plants are being built and equipped for this type of manufacture. Laboratory-scale experiments by Prof. M. C. Boswell of Toronto University have indicated the possibility of recovering elemental sulphur from smelter fume, but this has not been proved on a large scale.

In the Scandinavian countries the use of pyrites in the chemical pulp mills is being promoted by constant improvement in the efficiency of the furnaces for roasting and in the equipment for removing dust. Norway has extensive reserves of pyrites rich in sulphur, and recently one of the large chemical pulp mills put in a plant for the utilization of pyrites. The largest pulp mills in Sweden are equipped for the use of either pyrites or sulphur. Working tests have proved the ability of the "Orkla Metoden" to produce sulphur from pyrites and the directors of the Orkla Grubeaktiebolag have decided on the construction of a refinery at Thamshavn in Orkedalsfjorden, Norway, to treat 200,000 tons of their pyrites annually. This plant is to be ready in the summer of 1931. The methods of recovery of sulphur from sulphide ores have been outlined by Caddick.[5]

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[5] Caddick, Arthur J., The Production of Sulphur from Pyrites by Sublimation or Volatilization: Min. Mag., vol. 40, No. 4, April, 1929, pp. 220–221.

In Australia the production of sulphuric acid from sulphide ores is being developed. A new plant for the production of pyrites is under way at Captain's Flat in New South Wales near Canberra.

WORLD PRODUCTION

The world production of sulphur in 1929 is estimated to be about 2,805,000 long tons. The following table shows the production of sulphur by the principal countries during the last decade:

Production of sulphur in the principal producing countries, 1920–1929, in long tons

Year	United States (sulphur)	Italy		Japan		Chile (sulphur)	Spain (sulphur)
		Sulphur	Ore	Sulphur	Ore		
1920	1,255,249	259,440	31,983	38,975	27,725	13,129	12,200
1921	1,879,150	269,547	28,405	36,013	30,147	9,517	5,170
1922	1,830,942	164,696	22,347	34,095	41,424	12,057	13,028
1923	2,036,097	252,293	9,316	36,825	35,749	11,200	8,382
1924	1,220,561	290,241	21,948	46,133	50,892	9,611	9,388
1925	1,409,262	259,428	26,821	46,962	42,620	8,929	7,859
1926	1,890,027	267,107	33,088	47,020	46,545	8,787	9,351
1927	2,111,618	300,888	23,487	60,371	16,505	12,303	10,065
1928	1,981,873	291,430	31,051	68,956	13,109	15,423	10,199
1929	2,362,389	318,000	(1)	58,718	(1)	[2] 16,000	[2] 10,000

[1] Data not available.

[2] Estimate.

Sicily, the chief source of sulphur besides the United States, is reported to have produced 226,000 long tons in 1929, as compared with 212,000 tons in 1928. The sulphur output of Sicily in 1929 came from 216 mines; 89,000 to 98,000 tons of the total came from 5 mines, 98,000 tons from an additional 30 mines, and the remaining 30,000 tons from 181 mines. The tendency toward integration of the Sicilian sulphur industry, mentioned in the 1928 chapter of this series, continued throughout 1929. The large number of small mines using uneconomical methods are being closed down or consolidated with larger and better equipped mining companies. The report of the Sicilian Sulphur Consortium for 1927–28 contains the following statement regarding the sulphur situation in Sicily:

> Only the reduction of extraction costs can assure the producer of a market for his sulphur in the future, and by offering a more adequate margin of profit, attract to the industry investing capital, which to-day with slim profits earned and the great risk involved, is loath to enter this field.

Electric power is now being installed at the mines to reduce the cost of producing sulphur. The sulphur situation in Sicily is being investigated by the Italian Government in order to determine whether or not the consortium should be renewed when it expires on July 30, 1930. Nothing in the Italian situation indicates that the consortium will be dissolved as there is necessity for a representative central body to act for the entire industry. The agreement between the consortium and the American producers continues in effect and operates smoothly, much to the interest of the Sicilian producers.

The production of sulphur in continental Italy, chiefly in the Marches and Romagna, is estimated at 92,000 long tons in 1929 and is assuming greater importance. The total Italian sulphur production was 318,000 long tons in 1929, compared with 291,430 tons in 1928, an increase of 9 per cent.

The shipments of sulphur from Italy increased from 189,312 long tons in 1928 to 218,332 tons in 1929, an increase of 15 per cent. A table showing the quantity and destination of the consignments follows.

Sulphur exported from Italy, 1928 and 1929, by destinations, in long tons

Destination	1928	1929	Destination	1928	1929
Europe:			Africa:		
Austria	12,755	13,627	Algeria	2,461	4,331
Belgium	822	2,901	British South Africa	673	637
France	31,500	34,775	Egypt	1,726	1,545
Germany	6,397	4,919	Tunisia	1,135	1,720
Greece	14,810	8,418	Asia:		
Hungary	1,238	531	British India	11,468	13,879
Netherlands	1,211	123	Netherland East Indies	8,376	15,033
Portugal	7,358	7,784	Turkey in Asia	3,159	2,982
Rumania	1,887	1,601	South America:		
Spain	1,864	3,135	Argentina	1,794	6,304
Sweden	7,779	17,433	Brazil	3,136	1,207
Switzerland	1,459	1,176	Uruguay	1,444	1,439
Turkey in Europe	405	308	Australia	480	448
Union of Socialist Soviet Republics	---------	14,931	Other countries	21,500	17,880
United Kingdom	40,219	37,217		189,312	218,332
Yugoslavia	2,256	2,048			

Japan produced 58,718 long tons of sulphur in 1929, a decrease of 10,238 tons, or 15 per cent, from the output in 1928. Most of the Japanese sulphur comes from the island of Hokkaido and is used in Japan, but small exports go to near-by China and Hong Kong.

Although Spain's output of sulphur is insufficient for its own consumption the production is increasing and for 1929 is estimated at 10,000 long tons. The Tigon Mining & Finance Corporation (Ltd.) is actively engaged in developing its property in the Province of Almería. Drilling and prospecting have justified the construction of a plant for treating the ore which runs about 25 per cent sulphur. The first unit of the new plant is designed to have a capacity of from 70 to 100 tons of ore per day and is capable of rapid expansion when desired.

The production of Chile probably exceeded 16,000 tons in 1929 and is showing a tendency to increase. Enormous deposits of sulphur occur at high altitudes in the volcanic regions of Chile, but their development is retarded by the rigors of climate and hardships to be endured when working at altitudes of 5,000 meters. Most of the sulphur is used in Chile; the principal consumption is in the nitrate industry, in vineyards, aud on sheep ranches. It is reported that a British company is interested in acquiring the sulphur deposits in the Arica district.

Native sulphur is also mined in Greece, where about 2,000 tons is obtained annually; practically all of this comes from the volcanic island of Melos.

It is reported that a refinery has been erected in the Kara-Kum desert east of the Caspian Sea in Turkmenistan, where the existence of an immense sulphur deposit containing several million tons has been definitely established. The production is not known but is probably small because of the distance from the deposit to railroads, the product being transported 125 miles on camels. Further development of this deposit within the next few years is expected to help satisfy the requirements of the Soviet chemical, match, textile, rubber, and paper industries. Another operation at the Chekur-Koyashkoe deposits at Kerch on the Crimean Peninsula is expected to produce small amounts for local consumption. The reserves are neither great nor of high grade.

Small production of sulphur came from New Zealand, China, and several other countries.

It was reported during the year that rich sulphur deposits were being developed on the west shore of the Gulf of California, south of San Felipe, in Lower California, Mexico. There is no reported production or shipments to date. Consul Frank Bohr of Mexicali, Mexico, states:

> Activities indicate that the deposit is about 13 feet in depth of practically pure sulphur, followed by 13 feet of a mixture of sulphur, gypsum, silica, etc. The tract of land on which the development work is taking place is 1½ to 2 miles long and 500 to 600 feet wide, and other deposits are near by. The deposit is 4 miles from the coast in a comparatively level region, but on account of shallow water shipments would have to be made in lighters.

PYRITES

DOMESTIC PRODUCTION

The production of pyrites (ore and concentrates) amounted to 333,465 long tons, valued at $1,250,141, in 1929, compared with 312,815 tons, valued at $1,081,758, in 1928, an increase of 7 per cent in quantity and 16 per cent in value. The output exceeds in quantity that in any year since 1919 and in value that in any year since 1920. The above figures include the pyrite and pyrrhotite concentrates from copper operations in Tennessee and the by-product pyrites from zinc operations in Wisconsin; figures in earlier reports of this series did not include such concentrates. The following tables give the production of pyrites (ore and concentrates) in the United States during the last 20 years:

Pyrites produced in the United States, 1910–1929

Year	Long tons	Value
1910	241,612	$977,978
1911	301,458	1,164,871
1912	350,928	1,334,259
1913	341,338	1,286,084
1914	336,662	1,283,346
1915	394,124	1,674,933
1916	439,132	2,038,002
1917	482,662	2,593,035
1918	464,494	2,644,515
1919	420,647	2,558,172
1920	310,777	$1,596,961
1921	157,118	711,432
1922 [1]	169,043	671,241
1923 [1]	181,628	661,000
1924 [1]	160,096	645,262
1925 [1]	170,081	650,448
1926 [1]	166,559	616,668
1927 [1]	215,786	804,006
1928 [1]	312,815	1,081,758
1929 [1]	333,465	1,250,141

[1] Figures for 1928 and 1929 include by-product pyrites from zinc operations in Wisconsin and pyrite and pyrrhotite concentrates from copper operations in Tennessee. Similar output in earlier years (1922 to 1927) was not included in the statistics. Figures are given in the following table. The production of pyrite and pyrrhotite concentrates in Tennessee began in 1925.

The production of by-product pyrites from zinc operations in Wisconsin and of pyrite and pyrrhotite concentrates from copper operations in Tennessee, 1922 to 1929, was as follows:

	Long tons
1922	3,808
1923	9,007
1924	7,818
1925	23,561
1926	60,374
1927	87,040
1928	130,766
1929	169,101

In 1929 the pyrites produced contained approximately 120,371 long tons of sulphur, compared with 113,305 tons in 1928. The quantity of pyrites (ore and concentrates) sold or consumed by the producing companies totaled 336,456 long tons in 1929, compared with 310,250 tons in 1928.

In 1929, as in previous years, pyrites was produced in California, Tennessee, Virginia, and Wisconsin. Tennessee was the largest producer in 1929.

TENNESSEE

The pyrites output of Tennessee comes from the Tennessee Copper Co. and the Ducktown Chemical & Iron Co., both operating in the Ducktown Basin, in Polk County.

The Tennessee Copper Co. operated the Burra Burra and Eureka mines during 1929. The Burra Burra mine is much the larger operation and is the chief source of the ore smelted and treated in the company's smelter and acid plant at Copperhill. This mine operates steadily and furnishes a regular output of 40,000 tons of ore per month. The Eureka mine is operated irregularly and produces a much smaller tonnage of high-sulphur ore, the rate of output depending upon the demand for sulphur in acid making. The methods of mining at these properties are described by McNaughton.[6] During 1928 about 40 per cent of the combined output of these mines was concentrated in the flotation plant near the mines. The pyrite and pyrrhotite are recovered in the mill by selective flotation; the mill also makes copper concentrates and zinc concentrates. During the year the Polk County mine was unwatered and development work started.

The Ducktown Chemical & Iron Co. operates the Mary mine and the Isabella mine in the Ducktown district in Tennessee and the Fontana mine in North Carolina. The only pyrites produced comes from the mill at the Isabella mine, where pyrite concentrates and pyrrhotite concentrates are made by selective flotation. In the operation of the mill the chalcopyrite is first floated off, then the pyrite, and then the pyrrhotite. Iron concentrates (magnetic) of a third type are made with a Dings magnetic separator. The three types of iron concentrates are then mixed and sent to the roasters.

VIRGINIA

The only pyrites production from Virginia in 1929 came from the Gossan mine at Cliffview in Carroll County. The mine was operated by the General Chemical Co., which produced both lump and fines.

CALIFORNIA

The companies producing pyrites in California in 1929 were the Leona Chemical Co. in Alameda County and the Mountain Copper Co. (Ltd.) in Shasta County.

The Leona Heights mine, operated by the Leona Chemical Co., is about 4 miles southeast of Oakland, Alameda County, and has had a continuous record of production since 1912. The deposits occur in a narrow belt of rhyolite lava that extends more or less continuously along the west front of hills bordering the bay from Berkeley nearly to Decoto, and at the Leona Heights mine has a maximum width of 1½ miles. A new section of the mine was opened up by adit in 1926; all ore is now coming from this section, which is 25 feet thick and is covered by 60 to 80 feet of overburden. The pyrites averages about 47 per cent sulphur; it carries $1 to $2 per ton in gold and approximately 1 per cent copper, but the metal values are not recovered. The sulphur content is used by the Stauffer Chemical Co.

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[6] McNaughton, C. H., Mining Methods of the Tennessee Copper Co., Ducktown, Tenn.: Inf. Circ. 6149, Bureau of Mines, June, 1929, pp. 1–18.

Late in 1929 the Mountain Copper Co. (Ltd.) suspended the production of pyrites from the Hornet mine owing to competition from pyrites imported into San Francisco from the Britannia Mining & Smelting Co., of British Columbia. The Hornet mine has been producing 200 to 300 tons daily for the last 20 years, and there is still enough ore blocked out to permit shipping for several years. This mine has furnished the sulphur for a large part of the sulphuric acid used in the oil refineries along the Pacific coast. A reduction in the freight rates from Shasta County may permit resumption of production.

WISCONSIN

The only company reporting pyrites production in Wisconsin in 1929 was the National Zinc Separating Co., which is producing a pyrite concentrate at its magnetic separating plant at Cuba City from raw zinc concentrates produced at several mines in the Platteville district. The ore is mined by the system used in southeast Missouri and Joplin and contains principally sphalerite, pyrite, and galena. The zinc-pyrite concentrates from the mills are brought together at the roasting plant. A preliminary roast renders the iron sulphides magnetic, and after the calcines are cooled magnetic concentrates are made with a rotating magnetic disk and then given a dead roast to remove the sulphur. The gases from the preliminary and dead roasts are used in the manufacture of sulphuric acid.

IMPORTS

The imports of pyrites amounted to 514,336 long tons, valued at $1,507,648, in 1929, compared with 457,123 tons, valued at $1,135,463, in 1928, an increase of 13 per cent in quantity. The increase in 1929 followed an 82 per cent increase in 1928. The imports in 1929 were greater than in any year since 1917. The continuation of the $18 per long ton price at the mines for brimstone has allowed a larger importation of pyrites, mostly from Spain. The trend in the imports of pyrites from 1910 to 1929 is shown in the following table.

Sulphur ore as pyrites, containing more than 25 per cent of sulphur, imported for consumption in the United States, 1910–1929

Year	Long tons	Value	Year	Long tons	Value
1910	803, 551	$2, 748, 647	1920	332, 606	$1, 660, 832
1911	1, 006, 310	3, 788, 803	1921	216, 229	818, 852
1912	970, 785	3, 841, 683	1922	279, 445	1, 199, 076
1913	850, 592	3, 611, 137	1923	263, 695	1, 254, 389
1914	1, 026, 617	4, 797, 326	1924	246, 737	598, 544
1915	964, 634	4, 817, 977	1925	276, 385	773, 925
1916	1, 244, 662	6, 728, 318	1926	366, 151	856, 981
1917	967, 340	5, 981, 457	1927	250, 794	647, 512
1918	496, 792	2, 741, 676	1928	457, 123	1, 135, 463
1919	388, 973	2, 176, 565	1929	514, 336	1, 507, 648

Of the total pyrites imported in 1929 Spain furnished 446,093 long tons, or 87 per cent, and Canada 68,243 tons, or 13 per cent. The countries from which pyrites has been imported since 1925 are shown in the following table:

Sulphur ore as pyrites, containing more than 25 per cent of sulphur, imported into the United States, 1925–1929, by sources

[General imports]

Country	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Canada	1, 211	$3, 539	1, 046	$2, 191	9, 203	$30, 992	56, 956	$192, 864	68, 243	$240, 411
Norway	--------	--------	--------	--------	--------	--------	7, 468	15, 611	--------	--------
Spain	275, 174	770, 386	365, 105	854, 790	241, 591	616, 520	393, 840	932, 261	446, 093	1, 267, 237
	276, 385	773, 925	366, 151	856, 981	250, 794	647, 512	458, 264	1, 140, 736	514, 336	1, 507, 648

Imports of pyrites from Spain are increasing and are consumed largely in the production of sulphuric acid at manufacturing centers on the eastern seaboard, notably Philadelphia, Baltimore, and New York. The Rio Tinto Co. holds a large interest in the Davidson Chemical Co., which uses Spanish pyrites extensively in the manufacture of sulphuric acid for its fertilizer plants.

Imports of pyrites from Canada increased 20 per cent in 1929, following an increase from 9,203 long tons in 1927 to 56,956 tons in 1928. This increase is due largely to the exportation from Canada to San Francisco, Calif., of pyrites flotation concentrates recovered from the waste tailings of the Britannia Mining & Smelting Co. in British Columbia. Similar operations in the eastern Provinces of Canada permit export of smaller quantities to inland United States.

Considering the recoverable sulphur content of imported pyrites to be 45 per cent the quantity of domestic sulphur replaced by imported pyrites in 1929 was 231,451 long tons.

WORLD PRODUCTION

The following table shows the world production of pyrites, together with the quantity of pure sulphur it is supposed to replace in the market. For the most part the figures are taken from the official sources of the countries concerned, supplemented by information taken from the publications of the Imperial Mineral Resources Bureau and other reliable sources.

World production of iron pyrites (including cupreous pyrite), 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Algeria:					
Gross weight	12,566	11,505	12,918	13,825	16,804
Sulphur content	5,950	5,386	6,071	6,498	7,730
Austria:					
Gross weight	25,072	22,293	19,328	10,000	(1)
Sulphur content	5,712	5,137	3,153	2,000	(1)
Canada:					
Gross weight	14,157	16,189	46,142	62,447	70,087
Sulphur content	6,883	8,142	22,887	35,007	39,949
Cyprus: [2]					
Gross weight	176,036	152,776	211,462	243,913	295,772
Sulphur content	88,018	76,387	105,731	121,956	(1)
Czechoslovakia:					
Gross weight	21,594	22,512	23,300	23,626	23,005
Sulphur content	8,854	9,005	9,203	9,332	9,087
France:					
Gross weight	212,559	192,340	203,700	202,084	(1)
Sulphur content	[3] 90,187	90,748	(1)	(1)	(1)
Germany:					
Gross weight	223,293	237,870	350,430	342,179	(1)
Sulphur content	83,041	98,939	149,531	145,866	(1)
Great Britain:					
Gross weight	5,373	4,307	4,968	4,440	4,441
Sulphur content	(1)	(1)	(1)	(1)	(1)
Greece:					
Gross weight	65,000	81,000	100,050	94,270	(1)
Sulphur content	31,525	39,577	48,884	45,360	(1)
Hungary:					
Gross weight	138	176	3,666	4,222	1,023
Sulphur content	(1)	(1)	(1)	(1)	(1)
Italy:					
Gross weight	533,737	594,479	625,338	558,390	698,550
Sulphur content	243,922	273,248	286,227	256,683	(1)
Japan:					
Gross weight	312,627	417,513	506,089	593,972	(1)
Sulphur content	(1)	(1)	(1)	(1)	(1)
Norway:					
Gross weight	624,375	634,836	617,044	738,535	739,597
Sulphur content	266,903	272,330	266,855	321,630	323,844
Poland:					
Gross weight	11,217	18,850	24,596	10,668	9,410
Sulphur content	(1)	(1)	(1)	(1)	(1)
Portugal:					
Gross weight	217,296	210,487	301,035	242,122	384,350
Sulphur content	(1)	(1)	(1)	(1)	(1)
Rumania:					
Gross weight	26,983	42,039	25,514	23,715	23,851
Sulphur content	(1)	(1)	(1)	(1)	(1)
Russia: [4]					
Gross weight	54,996	109,394	225,318	100,137	(1)
Sulphur content	16,800	(1)	(1)	(1)	(1)
Spain:					
Gross weight	3,359,240	3,654,789	3,610,694	3,624,819	3,867,250
Sulphur content	1,539,846	1,658,391	1,609,776	1,439,747	(1)
Sweden:					
Gross weight	69,873	69,759	69,239	19,996	(1)
Sulphur content	26,695	27,073	32,126	12,394	(1)
Union of South Africa:					
Gross weight	2,512	2,448	2,254	3,754	4,116
Sulphur content	(1)	(1)	(1)	(1)	(1)
United States:					
Gross weight	[5] 172,811	[5] 169,232	[5] 219,249	317,836	338,817
Sulphur content	70,927	67,502	84,909	115,124	122,303
Yugoslavia:					
Gross weight	38,988	53,376	57,003	64,273	61,153
Sulphur content	(1)	(1)	(1)	(1)	(1)

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[1] Data not available.

[2] Exports.

[3] Exclusive of sulphur content of 13,516 tons of iron pyrite, for which figures are not available.

[4] Year ended Sept. 30.

[5] Exclusive of by-product pyrites from zinc operations in Wisconsin and of pyrite and pyrrhotite concentrates from copper operations in Tennessee.

SPAIN

The production of copper and iron pyrites in Spain in 1929 was 3,867,250 metric tons, slightly above the level maintained steadily for the preceding three years. The Rio Tinto Co. is directly interested in the development of processes for the recovery of by-product sulphur from pyrites; the first full-scale unit is now completed, and the marketing of by-product sulphur may begin in 1930.

NORWAY

Pyrite production in Norway in 1929 was nearly 740,000 metric tons. The Orkla Grubeaktiebolag produced more than half of the total and during the year shipped 390,000 metric tons. The mine is reported to have 20,000,000 tons of ore reserves with sulphur content of about 42 per cent. The ore contains considerable copper, and that produced in 1929 contained better than 2.72 per cent copper. The company has developed the "Orkla Metoden" for the production of sulphur from pyrites and is planning a new refinery at Thamshavn in Orkedalsfjorden to treat 200,000 tons of its pyrites annually. The plant will be ready in the summer of 1931. The Sulitelma A. B. Co., in the Sulitelma district, has an annual production of 100,000 to 160,000 tons of pyrite and copper pyrites and is operating under a perpetual grant of long standing. The company is a subsidiary of the Reymersholms Co. of Helsingborg.

ITALY

The production of pyrites in Italy was 698,550 metric tons in 1929, compared with 558,390 tons in 1928, an increase of 25 per cent. The mining industry in Italy still feels the effects of the revalorization of the lira, with labor costs equal to more than 50 per cent of the total mining costs. The Montecatini Co. is by far the largest producer in Italy, contributing 534,269 tons, or 76 per cent of the total Italian production in 1929. During the year the company started production from the Rigolaccio mine near Gonzano after the proving of a large body of ore in an entirely new zone. An interesting new tonnage is also assured in its New Niccioletta property.

CANADA

The production of pyrites in Canada, according to the Dominion Bureau of Statistics, in 1929 amounted to 77,258 short tons, of which 56,395 tons came from British Columbia, 20,186 tons from Quebec, and 677 tons from Ontario. The pyrites produced in British Columbia is flotation concentrates from the Britannia mill, which is now handling about 6,000 tons of ore a day. The recovery of pyrites from the mill tailings at this plant is responsible for a large part of the increased production of pyrites in Canada in 1927, 1928, and 1929. The product is used locally in the pulp and paper industry and some is exported to the United States. Pyrites production in Quebec jumped from 4,389 short tons in 1928 to 20,186 tons in 1929, probably as the result of increased production of flotation concentrates from the Eustis mine near Sherbrooke. There was only one producer of pyrites in Ontario during 1929, the Canadian Pyrites (Ltd.), which shipped 156 tons of lump and 521 tons of fines, containing from 38 to 42 per cent of sulphur, from the Caldwell mine near Flower Station. Early in 1930 the Treadwell Yukon Co. was producing daily about 60 tons of pyrites concentrates, containing 50 per cent of sulphur, from the pilot mill at the Errington mine in the Sudbury district. The company is assured of a net return of $1 per ton for the sulphur content of the iron pyrites. With the 2,000-ton mill contemplated it could produce daily between 600 and 700 tons of high-grade iron pyrites concentrates, which would be available for the manufacture of sulphuric acid and for pulp manufacture in the Great Lakes regions of the United States and Canada. The high cost of delivered sulphur is causing increased activities in pyrites production in the inland districts of Canada and the United States.

AUSTRALIA

A project is now under way at Captain's Flat near Canberra to obtain pyrites to the amount of 50,000 tons per year. Maximum production, however, will not be reached possibly for three or four years. Sulphuric acid will be made for use in the manufacture of superphosphate fertilizers.

YUGOSLAVIA

Increased activity in the mining of pyrites in Serbia has resulted in a production of 61,153 metric tons in 1929, as compared with only 3,682 tons at the beginning of the decade.

GREECE

Greece produces about 100,000 tons of pyrites annually, almost entirely from the mines of Isvoros on the Khalkidike Peninsula. Other mines are those of Polygyros and Molivoporgos at the head of the Gulf of Cassandra. Pyrites mines have also been worked in the Paliuri district near the southern end of the Cassandra Peninsula; the Hermione district near the southern end of the peninsula of Argolis in the Peloponnesus has resumed production after some years of inactivity.

ASBESTOS[1]

By Oliver Bowles and B. H. Stoddard

INTRODUCTION

In 1929 the domestic raw asbestos industry in the United States was stimulated by the opening up of the Bear Canyon asbestos mine in Arizona by Keasbey & Mattison, of Ambler, Pa., and by the revival of activities by the Vermont Asbestos Corporation, Boston, Mass., whose property is near Hyde Park, Vt. Both production and sales of domestic chrysotile increased in quantity but decreased in value, while amphibole showed increases in both quantity and value. Prices of Canadian fiber, which control the American market, remained fairly constant; demand, especially for the higher grades, was good throughout the year; imports of unmanufactured asbestos increased 14 per cent in quantity and 24 per cent in value, as compared with 1928; and at the end of 1929 sufficient stocks of all grades were available to supply requirements.

VARIETIES OF ASBESTOS

The term "asbestos" was originally applied to fibrous amphibole, a variety which is of minor importance at present. The term is now applied to any mineral that may be separated into more or less flexible fibers. At least six commercial types of fiber are known as asbestos. Their composition and general character are given in the following paragraphs.

Chrysotile is a hydrous magnesium silicate represented by the chemical formula $H_4Mg_3Si_2O_9$. It has the same composition as serpentine, with which it is always associated. Chrysotile is the most important of all the commercial varieties and provides most of the spinning fiber.

Anthophyllite is an anhydrous iron-magnesium silicate having the composition $(Fe,Mg)SiO_3$. The fiber is usually brittle and of low tensile strength. It is used for nonspinning purposes and is more resistant than chrysotile to the action of acids and heat.

Crocidolite is a soda-bearing amphibole having the composition $NaFe(SiO_3)_2.FeSiO_3$. On account of its characteristic color it is commonly called "blue" asbestos. It is used for spinning purposes.

Amosite is an iron-rich anthophyllite containing very little magnesium. It is a spinning asbestos notable for its great length of fiber.

Tremolite, having the composition $CaMg_3(SiO_3)_4$, and

Actinolite, $Ca(Mg,Fe)_3(SiO_3)_4$, are amphiboles that may be classed as asbestos when occurring in fibrous form; in fact, they are the minerals to which the term "asbestos" was first applied. The fibers are weak and brittle and at present have little value commercially. A small production of actinolite has been reported from Canada.

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[1] Work on manuscript completed September, 1930.

PROPERTIES OF ASBESTOS

The higher grades of asbestos differ from all other minerals in that they may be separated readily into fine, flexible, strong, silky fibers. Thus they possess qualities unknown to any other substance, for they may be spun into yarn or thread, woven into cloth, or felted into sheets or packings in the same way that a vegetable or animal fiber may be treated, but unlike cotton or wool they consist of inert incombustible matter and are therefore fireproof, weatherproof, and highly resistant to chemical action.

In its commercial classification asbestos falls into two divisions, the spinning and the nonspinning fibers. Chrysotile, crocidolite, and amosite have sufficient strength and flexibility for spinning if the fiber is long enough, and the shorter fibers of these varieties are used for nonspinning purposes. Chrysotile is usually regarded as the highest grade of spinning fiber, although with improved processes of fiberization and treatment crocidolite (blue asbestos) and amosite are giving good results. Anthophyllite is chiefly nonspinning, even though the fiber may be of great length, as it is usually very weak and brittle.

USES

Fiber of spinning quality is woven into various fabrics, the chief of which is that used for automobile brake-band linings. Other important uses for asbestos fabrics are clutch facings, packings, theater curtains, and fireproof suits and gloves. Grades of asbestos shorter than those used for spinning are used in compressed sheets, paper, and asbestos-cement shingles. On account of its heat-insulation and fire-resisting properties asbestos paper is used chiefly for the manufacture of 3-ply air cell and other types of pipe covering, as sheeting between floors, and for lining stoves, safes, filing cabinets, etc.

The shortest grades are used in asbestos cement, fireproof paints, packings, and insulating materials. There are many other uses too numerous to mention in this report.

GRADES

The highest grades of asbestos are known as crude fibers, which are hand cobbed and are not passed through crushers or mills. Crudes and the highest grade mill fiber provide material for spinning purposes.

Millstock is the product obtained by crushing the rock, passing it through beaters, and removing the fiber by screening and air separation. It is graded and classified according to length. Canadian fiber is graded in a standard testing machine that consists of 4 boxes, 3 of which have screen bottoms. The top screen is 2 mesh, 11 gage; the second, 4 mesh, 17 gage; and the third 10 mesh, 20 gage. The fourth or lowest box retains the finest materials. Sixteen ounces of asbestos are placed on the top box, and the entire set is shaken for 2 minutes at 300 revolutions per minute on a machine with a three-fourths-inch eccentric. The residue in each box is weighed, and the fiber is graded by the amount that remains in each box. The longer the fiber, the larger is the proportion that remains in the upper boxes. The following table gives the screen test for the various grades:

Grades of mill fiber

Grades according to use	Screen test
Long spinning fiber	2–8 – 4 – 2
Medium spinning and compressed sheet fiber	0–8 – 6 – 2
Shingle stock	0–1½– 9½– 5
Paper and millboard stocks	0–0 –10 – 6
Cement stock	0–0 – 5 –11

PRODUCTION

The quantity of asbestos sold by producers in the United States was greater in 1929 than in any year since 1912, amounting to 3,155 short tons, valued at $351,004. The gain in 1929 was due largely to increased activity in Arizona, where the number of producers increased from four in 1928 to six in 1929. The total of 3,155 tons represents 1,983 tons of chrysotile (the fibrous variety of serpentine), valued at $317,584, mined in Arizona and Vermont, and 1,172 tons of anthophyllite (amphibole), valued at $33,420, mined in Georgia, Maryland, Montana, and North Carolina. As compared with 1928, figures for chrysotile, which is commercially the more important variety, showed an increase in quantity but a decrease in value, while the figures for anthophyllite indicated increases in both quantity and value.

Figures for chrysotile include both crude and mill fiber and therefore represent a combination of high-grade and low-grade fiber. Anthophyllite is also produced as long and short fiber, and, in order to avoid disclosing confidential data, the figures for the high-grade long fiber from Maryland, used since 1918 for making chemical filters, are combined with those for mass fiber anthophyllite produced in Georgia, Montana, and North Carolina.

In Arizona the average value for total crude asbestos (Nos. 1, 2, and 3) was $311 per ton in 1929, and ranged from $450 to $600 for No. 1, from $225 to $500 for No. 2, and from $75 to $275 for No. 3. The average value for all mill-fiber asbestos (Nos. 1, 2, and 3) sold in Arizona in 1929 was $171.

Asbestos sold by producers in the United States, 1920–1929, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	1, 245	$661, 907	403	$16, 324	1, 648	$678, 231
1921	438	313, 268	393	23, 700	831	336, 968
1922	25	3, 320	42	6, 800	67	10, 120
1923	69	4, 433	158	5, 193	227	9, 626
1924	173	33, 941	127	8, 585	300	42, 526
1925	93	40, 750	1, 165	10, 950	1, 258	51, 700
1926	(1)	(1)	(1)	(1)	1, 358	134, 731
1927	(1)	(1)	(1)	(1)	2, 981	336, 882
1928	(1)	(1)	(1)	(1)	2, 239	351, 178
1929	1, 983	317, 584	1, 172	33, 420	3, 155	351, 004

[1] Bureau of Mines not at liberty to publish figures.

Following is a list of producers of asbestos in the United States making shipments in 1929.

Producers of asbestos in the United States making shipments in 1929

Name and address	Location of property	Variety of asbestos mined
ARIZONA		
Arizona Asbestos Association (subsidiary of Johns-Manville Corporation), Globe.	Chrysotile, on Ash Creek, Gila County.	Chrysotile (in limestone), cross fiber.
Emsco Asbestos Co., Downey, Calif.	Gila County; nearest post office, Rice.	Chrysotile (in limestone).
International Asbestos Co., Globe	45 miles north from Globe, Gila County.	Chrysotile (in limestone), cross fiber.
Keasbey & Mattison Co., Ambler, Pa.	Gila County; nearest post office, Rice.	Do.
Regal Asbestos Mines (Inc.), 220 Broadway, New York, N. Y.	do	Do.
Triangle Asbestos Co., Young	Gila County; at confluence of Walnut and Cherry Creeks.	Do.
GEORGIA		
Clayton Paving Co., 615 Independent Life Building, Nashville, Tenn.	Sall Mountain, White County.	Amphibole (anthophyllite), mass fiber.
MARYLAND		
Powhatan Mining Corporation, Woodlawn, Baltimore.	1 mile northwest from Pylesville.	Amphibole (anthophyllite), slip fiber.
MONTANA		
Peter F. Karst, Gallatin Gateway	20 miles south from Gallatin Gateway.	Amphibole (anthophyllite).
NORTH CAROLINA		
National Asbestos Co., Plumtree	Near Minneapolis, Avery County.	Do.
VERMONT		
Vermont Asbestos Corporation, 89 Broad Street, Boston, Mass.	Eden, Lamoille County	Chrysotile, cross and slip fiber.

REVIEW BY STATES

Arizona.—Although the production of chrysotile in Arizona in 1929 fell below the record made in 1928, the number of producers was increased by two. The production was nearly all crude Nos. 1 and 2, the highest grades of chrysotile. It should be remembered that the peculiar occurrence of asbestos in Arizona (which necessitates regular mining methods), the difficulties of transportation to distant shipping points, and other factors necessarily limit the output, but the high quality of the material assures its value. The entire output of the Arizona Asbestos Association (a subsidiary of the Johns-Manville Corporation) at Chrysotile was reported as crude Nos. 1 and 2. The Regal Asbestos Mines (Inc.) (E. Schaaf-Regelman) reported an output of Nos. 1 and 2 crude and also a small production of mill fiber; the usual maintenance work was carried on. The International Asbestos Co., Globe, made sales from stock on hand, which consisted of several grades of mill fiber and a small quantity of No. 3 crude. The firm of Keasbey & Mattison, Ambler, Pa., was a new producer in this field, having opened up the Bear Canyon mine during the early part of the year. The property is situated about 21 miles north from Rice. The entire output, which was crude Nos. 1 and 2, was used in the company's own factories, largely in the manufacture of woven tapes, for which purpose it is especially suitable. The company stated that—

> The fiber is prepared for commercial use by crushing and milling the crude asbestos rock, in order to separate and eliminate the asbestos-bearing matrix through the use of vibratory screening methods, thereby leaving the pure asbestos fiber as a fluggy, silky mass, having lost all semblance of a rock or mineral, and appearing not unlike silken fibers of vegetable or animal origin.
>
> This asbestos is then carded, or combed, in order to lay all of the minute fibers in the same direction, which is necessary before they can be used in a spinning frame. The carded fiber is not unlike carded cotton in appearance, and for some uses the asbestos is mixed with a certain percentage of this or other vegetable fiber, depending upon the use that is to be made of the product manufactured from such a mixture. Spinning machines of various types next convert the carded asbestos fiber, or mixture of fibers, into the types of yarns which are the basis of all spun or woven asbestos textile products, among which may be mentioned asbestos threads, yarns, automobile brake-band linings, clutch facings, braided asbestos packings, gaskets, tubings, cloth garments, tapes, sheet packings and many other industrial asbestos products.

The Triangle Asbestos Co., Young, erected a mill, installed air compressors, and built three houses and a commissary. The company produced and sold three grades of crude, but later closed down. A change of ownership took place when the Emsco Asbestos Co., of Downey, Calif., purchased from Robert M. Anderson the property, known as the Accident group of claims, which lies on the west side of Cienega Canyon, about halfway between the falls of Cienega Creek and Salt River (nearest post office, Rice). Three grades of mill fiber were reported sold, and usual development work was reported carried on.

California.—No sales of asbestos in 1929 were reported from California. J. E. Barrett, Bryson, reported having taken over all interests of Walter R. Harris in the property near Jolon, in Monterey County. Development work only was maintained.

Georgia.—Operations in Georgia were those of one producer only—the Clayton Paving Co. The company sold anthophyllite from its property near Helen, White County.

Maryland.—The Powhatan Mining Corporation produces two grades of material—a long and carefully prepared fiber and a very short fiber—both of which are used in the chemical industry. The mine (Jenkins) is near Pylesville and was the only one in Maryland in operation during 1929. The property is developed by the open-pit method.

Montana.—P. F. Karst, Gallatin Gateway, produced and sold a small quantity of asbestos from his property in Gallatin County, 20 miles from Gallatin Gateway. The property was purchased June 1, 1929, from E. J. Durnan. The Vermiculite & Asbestos Co. confined its activities to development work. The property is 7 miles northeast from Libby, Lincoln County.

North Carolina.—The National Asbestos Co., Plumtree, reported that it had made shipments from its plant during the year. Early in 1929 the Amphibole Asbestos Corporation, Chicago Ill., through F. C. Worth, purchased the property known as the Fox Estate, 2 miles east of Burnsville, Yancey County, and started general development work.

Oregon.—L. B. Larson, Baker, reported the usual development work, which resulted in the production of several tons of asbestos which was used for experimental purposes.

Vermont.—In 1929 production was reported from Vermont for the first time since 1922, when experimental operations were carried on by the Asbestos Corporation of America at its property in Lamoille County near Hyde Park. In 1923 activities were suspended. Since that time the company has been reorganized under the name of the Vermont Asbestos Corporation, operations have been resumed, and a total of 1,049 short tons of mill-fiber asbestos, valued at $47,799, was reported as sold in 1929.

MARKET CONDITIONS

Foreign supplies of asbestos are of very great importance to the United States, for while this country leads all others in the manufacture of asbestos products it produces a very small percentage of its requirements. Canada has for many years been the chief source of supply and still holds the position of being practically the only source of supply of the shorter fibers. Increasing quantities of the longer fibers, especially those used for spinning purposes, are obtained from Africa and Russia.

Price quotations for Canadian fiber remained remarkably constant throughout 1929. Crude No. 1 ranged from $550 to $750 per ton and shingle stock from $55 to $110, depending on quality; cement stock was about $25 per ton. The recession in building activity led to restricted demand during November and December, with the probability of falling prices. Just as in 1928, the industry was highly prosperous throughout the world.

OUTSTANDING EVENTS

As previously noted, an event of considerable importance is the renewal of activity in the Vermont asbestos area, from which no fiber has been obtained for a number of years.

Considerable interest has been shown in the use of X-ray methods for determining the properties of asbestos as a means of classification. It is claimed that X-ray studies will uncover fundamental physical data not obtainable by ordinary optical methods of investigation.

Reference was made in the chapter of this series for 1928 to numerous consolidations of manufacturing and producing companies. The absorption of Bell's United Asbestos Co. (Ltd.) by Turner & Newall (Ltd.) was noted. The latter firm has further increased its prestige through recent amalgamation with the Rhodesian & General Asbestos Corporation (Ltd.); this consolidation unites the largest manufacturer of asbestos products in the world with the largest producer of high-grade raw material. The important mines now controlled by Turner & Newall (Ltd.) are as follows: The Nil Desperandum, Shabani, and Birthday mines, at Shabani (Rhodesia); the King's, Gath's, and Regina mines, in Mashaba (Rhodesia); the New Amianthus, at Kaapsche Hoop (Transvaal); the mines of the Dominion Blue Asbestos Mines (Ltd.) (Cape Colony); and the Havelock mine, a new acquisition, in Swaziland. The company thus controls the major share of African production. Lowering of price levels is forecast, but this may be compensated by wider utilization of asbestos products throughout the world.

In connection with this consolidation an international cartel of asbestos-cement manufacturers has been formed. Some of the important objects of the cartel are exchange of technical knowledge, the establishment in Switzerland of an institute of research for the entire industry, organization of export business, standardization of quality, limitation of varieties of products, and also supplying needs in raw material of all members of the cartel. The principal manufacturers of asbestos-cement building products in Great Britain, Czechoslovakia, Belgium, France, Holland, Austria, Italy, Hungary, Spain, Switzerland, and Germany are involved in the cartel.

Another important consolidation reported about the middle of the year 1929 was that of the Raybestos Co. of Bridgeport, Conn., the Manhattan Rubber Manufacturing Co. of Passaic, N. J., and the United States Asbestos Co. of Manheim, Pa., to be known as the Raybestos-Manhattan (Inc.).

Interesting experiments are being conducted in methods of separating asbestos fiber from the associated rock in such a way that the fiber may be removed with the least possible breakage. Experimental work is being conducted at the laboratory of the Hardinge Co. at York, Pa., and at the Department of Mines, Ottawa, Canada. Some of the tests involve the use of rod mills and air flotation.

A new use of asbestos is its employment in the manufacture of phenolized sheets, the asbestos fiber being treated with formaldehyde or impregnated with bakelite resin. Such sheets are used in place of mica for low-tension insulation.

IMPORTS AND EXPORTS[2]

Only about 3 per cent (in value) of the asbestos used in the United States is of domestic origin; therefore, sources of foreign supply are of unusual importance to American consumers. The following tables show the imports and exports over a number of years, the imports in 1928 and 1929 by last port of shipment and by classes, and the exports in 1928 and 1929 of manufactured asbestos products.

Asbestos (unmanufactured) imported for consumption in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	167,558	$9,120,253	1925	230,520	$7,134,302
1921	72,463	2,948,302	1926	257,621	8,142,505
1922	149,427	5,144,700	1927	223,693	8,150,340
1923	212,420	7,445,143	1928	230,595	9,017,891
1924	183,250	5,602,945	1929	262,427	11,153,017

In the following table the countries given are merely those from which asbestos was last shipped, as shown by the invoices or manifests from which the records of imports were compiled. Probably British South Africa (Rhodesia and the Union of South Africa) was the actual source of practically all of the imports except those credited to Canada, Italy, and Germany; those from Germany originated chiefly in Russia.

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[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Asbestos (unmanufactured) imported into the United States, 1928 and 1929, by countries and classes

Country	Crude (including blue fiber)		Mill fiber		Stucco and refuse		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1928								
Africa:								
British—Union of South Africa	2,989	$492,638	230	$26,287			3,219	$518,925
Portuguese—Mozambique	2,148	594,979			2	$50	2,150	595,029
Other	171	39,082					171	39,082
Australia	94	36,911					94	36,911
Austria					29	809	29	809
Belgium	118	14,095	630	84,912			748	99,007
Canada	5,653	1,194,039	88,876	3,970,913	126,810	1,870,022	221,339	7,034,974
France	109	15,885					109	15,885
Germany	2,231	578,905	108	11,606			2,339	590,511
Italy	13	7,387	(1)	69			13	7,456
Malta, Gozo, and Cyprus Islands			1	84			1	84
Netherlands	91	18,038					91	18,038
United Kingdom	273	58,607	19	2,573			292	61,180
	13,890	3,050,566	89,864	4,096,444	126,841	1,870,881	230,595	9,017,891
1929								
Africa:								
British—Union of South Africa	3,680	585,240					3,680	585,240
Portuguese—Mozambique	4,524	1,578,514					4,524	1,578,514
Belgium	348	55,125					348	55,125
Canada	6,651	1,545,892	95,382	4,575,438	150,034	2,242,211	252,067	8,363,541
Germany	1,174	361,446					1,174	361,446
Italy	122	31,212	1	45	33	1,167	156	32,424
Soviet Russia in Europe	252	111,290					252	111,290
United Kingdom	225	65,341	1	96			226	65,437
	16,976	4,334,060	95,384	4,575,579	150,067	2,243,378	262,427	11,153,017

[1] Less than 1 ton.

The foregoing figures for imports of unmanufactured asbestos emphasize the growing importance of transoceanic trade in crude fibers. In 1929, 6,651 short tons of crude asbestos was imported from Canada and 10,325 tons from other countries, chiefly from Africa. Countries other than Canada supplied about 56 per cent of the United States imports of crudes in 1927, 59 per cent in 1928, and 61 per cent in 1929. In mill fibers and shorts, however, Canada enjoys almost a complete monopoly. In 1929 the United States imported 245,416 short tons of these grades from Canada and only 35 tons from all other sources.

Asbestos (unmanufactured) exported from the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	615	$141,071	1925	1,109	$70,846
1921	520	101,600	1926	1,104	85,922
1922	376	49,939	1927	309	48,774
1923	680	48,525	1928	850	346,632
1924	1,270	93,163	1929	709	108,467

Manufactured asbestos products exported from the United States, 1928 and 1929, by grades

Grade	1928		1929	
	Quantity	Value	Quantity	Value
Brake and clutch lining .... short tons..	(1)	$1,421,658	(2)	$1,520,585
Paper, millboard, and roll board .... do....	813	132,287	850	152,168
Pipe covering and cement .... do....	2,461	286,456	3,445	409,477
Textile yarn and packing .... do....	827	924,318	990	1,031,578
Magnesia and manufactures .... do....	2,929	354,562	3,130	391,628
Asbestos roofing .... squares..	67,143	445,567	92,204	600,420
Other manufactures, except roofing .... short tons..	1,447	434,174	2,446	534,743

[1] 7,749,743 linear feet; weight not recorded.

[2] 7,426,622 linear feet; weight not recorded.

WORLD PRODUCTION

The total production of asbestos by countries from 1925 to 1929, in so far as figures are available, is shown in the following table:

World production of asbestos, 1925–1929, in metric tons

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
Africa:					
Southern Rhodesia	31,161	30,249	30,097	36,251	38,677
Union of South Africa	9,224	12,789	20,085	21,821	29,970
Argentina [2]	----------	38	1	----------	(3)
Australia:					
New South Wales	----------	5	----------	----------	----------
Western Australia	51	107	11	12	259
Canada [4]	248,136	253,469	249,273	247,690	277,647
China	213	(3)	241	(3)	(3)
Cyprus [5]	3,343	6,433	11,079	11,765	14,017
Finland	1,347	1,674	1,298	1,462	1,563
France	2,200	660	(3)	(3)	(3)
India, British	16	59	69	159	(3)
Italy	2,105	2,500	3,600	4,800	(3)
Japan	1,174	(3)	(3)	(3)	(3)
Russia [6]	12,330	18,334	21,156	26,417	(3)
United States	1,141	1,232	2,704	2,031	2,862

[1] In addition to the countries listed, Bolivia, Brazil, and Madagascar are reported to produce small quantities of asbestos. Statistics of production are not available for Bolivia and Brazil, but exports reported are considerably less than a ton. Production in Madagascar is reported as follows: 1927, 23 kilograms; 1928, 108 kilograms; 1929, 545 kilograms.

[2] Rail and river shipments.

[3] Data not available.

[4] Exclusive of sand and gravel, the production of which is reported as follows: 1925, 15,300 tons; 1926, 14,217 tons; 1927, 18,398 tons; 1928, 20,672 tons; 1929, 17,215 tons.

[5] Exports.

[6] Year ended Sept. 30.

NOTES ON PRODUCTION IN FOREIGN COUNTRIES

CANADA

Quebec.—Production of asbestos from the Quebec mines in 1929 surpassed all previous records, exceeding the high record of 1926 by 26,666 short tons. Total production in 1929, exclusive of sand and gravel by-products, was 306,055 short tons, an increase of 33,022 tons over 1928. The increase was distributed with fair uniformity over spinning fibers, millboard, and paper stocks; short-fiber and cement-stock production remained about constant. The average price also exhibited an upward trend—from $41.16 per ton in 1928 to

$43.04 in 1929. Stocks on hand increased somewhat during 1929, particularly the high-priced spinning fibers. As a whole the industry experienced a prosperous year. The Quebec industry celebrated its fiftieth anniversary in May, 1929, the first shipments of fiber having been made from Thetford Mines in 1879.

Increasing competition with South Africa is causing some unrest, but the location of the Quebec deposits on the threshold of the greatest asbestos-manufacturing center in the world, the high quality of the fiber, the ready market for short fiber, and the high degree of efficiency attained in mining and manufacture would seem to assure continued prosperity for the Canadian industry. Operating companies are directing their efforts toward cost reduction and the preparation of uniformly graded high-quality products.

Production figures for Quebec, the only Province in Canada from which asbestos was reported during 1929, are given in the following table:

Production of asbestos in the Province of Quebec in 1929

Designation of grade	Shipments and sales[1]		Average value per ton	Stocks on hand Dec. 31, 1929[2]	
	Short tons	Value		Short tons	Value
Crude No. 1	802	$447, 259	$557. 68	183	$102, 055
Crude No. 2	2, 625	870, 888	331. 76	315	104, 504
Other crudes	931	168, 226	180. 69	120	21, 683
Spinning stocks	17, 545	3, 110, 848	177. 30	2, 774	491, 830
Shingle stocks	34, 177	2, 572, 216	75. 26	10, 424	784, 510
Millboard and paper stocks	91, 157	3, 515, 209	38. 56	14, 683	566, 176
Fillers, floats, and other short fibers	158, 818	2, 487, 935	15. 66	25, 198	394, 601
	306, 055	13, 172, 581	43. 04	53, 697	2, 465, 359
By-products (sand and gravel)	18, 976	7, 303	. 38		
Totals	325, 031	13, 179, 884			

[1] Preliminary Rept. on the Mineral Production of Canada, Ottawa, 1929.

[2] Ann. Rept. Quebec Bureau of Mines, 1929, which states "Values calculated at average price of each grade. These figures are given merely as a guide to approximate valuation of stocks on hand."

Quantity of rock mined during the year 1929: 6,208,970 tons.
Quantity of rock milled during the year 1929: 4,885,023 tons.

AFRICA

Rhodesia.—Rhodesian production attained a new high record—42,634 short tons—in 1929, exceeding that of 1928 by 2,674 tons. For the first time in history production value exceeded £1,000,000. The largest producer, the Rhodesian & General Asbestos Corporation (Ltd.), has enjoyed remarkable prosperity, paying dividends and cash bonuses totaling 30 per cent on the ordinary shares for the financial year ended March 31, 1929. Important plant additions have been completed at both the Shabani and the Gath's mines, and similar improvements are to be made at the King's mine. This is the largest asbestos-mining company in the world. Recently it had on its pay roll 272 white men and 6,235 natives. Exploration and development during the past year have increased the established reserves at all the mines to quite an extent. A disastrous flood in December, 1928, curtailed production during the early months of 1929. As noted on page 200, the company has recently been merged with Turner & Newall (Ltd.).

Other producers in Rhodesia are the African Asbestos Mining Co. (Ltd.) (a subsidiary of Turner & Newall (Ltd.)), the Rhodesian Chrome & Asbestos Co. (Ltd.), J. S. Hancock, United Mining & General Trust, and the Vukwe Asbestos Syndicate (Ltd.).

Rhodesian production over a period of 10 years is shown in the following table.

Asbestos produced in Rhodesia, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	18,823	£459,572	1925	34,349	£766,381
1921	19,529	795,698	1926	33,344	726,835
1922	14,249	577,699	1927	33,176	794,215
1923	20,364	626,880	1928	39,960	970,327
1924	26,141	603,423	1929	42,634	1,186,627

Union of South Africa.—The Union of South Africa experienced a noteworthy growth in its asbestos industry, the production in 1929 exceeding that of 1928 by more than 37 per cent and the total value reaching almost £500,000. This country is unique in that it produces three varieties of asbestos—chrysotile, crocidolite (blue asbestos), and amosite. All three varieties are produced in the Transvaal, whereas blue fiber is the chief product of the Cape Province.

The chief producing companies in the Cape Province are the Cape Asbestos Co. (Ltd.) and the Dominion Blue Asbestos Mines (Ltd.), the latter a subsidiary of Turner & Newall (Ltd.).

In the Transvaal the mines of the Cape Asbestos Co. (Ltd.), the chief producer of amosite, were operated to full capacity, and a prosperous year is reported. The Chunes Asbestos Co. is producing both amosite and crocidolite in the Pietersburg district. Increasing utilization of amosite has led to several new developments in this territory, such as that of the South African Consolidated Asbestos Co. In March, 1929, Turner & Newall (Ltd.) acquired important amosite properties in the Malips Drift area of the Pietersburg district. Large tonnage production is predicted, although the district is handicapped by a 40-mile haul to the nearest railway.

Amosite will never take the place of chrysotile for many uses as it is coarser in texture, but remarkable success has been attained in developing markets for it. Much study and experimentation are being devoted to improved methods of treatment, whereby mill fiber will equal crude in quality.

The chief production of chrysotile in the Transvaal is derived from the New Amianthus mine, in the Barberton district, owned by Turner & Newall (Ltd.). The new aerial tramway, 5.9 miles long, from this mine to Elandshoek on the Delagoa Bay line is now in operation, and the tedious ox-wagon transport is no longer necessary. Munnik-Myburgh Asbestos (Ltd.) also operates near Barberton. Renewed activity is to be noted in the chrysotile deposits of the Carolina district. The African Asbestos Trust, a company incorporated in May, 1928, has demonstrated the presence of large reserves, and a pilot plant has been erected. Development work is also reported by the Kalkrans Asbestos Co.

The following table gives production over a period of 10 years:

Asbestos produced in the Union of South Africa, 1920–1929, in short tons

Year	Transvaal	Cape Province	Natal	Total	
				Short tons	Value
1920	3,541	3,526	45	7,112	£114,195
1921	1,593	3,467	62	5,122	103,067
1922	1,392	2,991	6	4,389	81,230
1923	4,076	4,317	------	8,393	121,453
1924	4,240	3,001	------	7,241	110,075
1925	7,628	2,540	------	10,168	152,115
1926	10,104	3,993	------	14,097	216,466
1927	17,313	4,827	------	22,140	343,301
1928	18,976	5,078	------	24,054	399,550
1929	26,984	6,030	23	33,037	497,393

The relative importance of the different varieties of asbestos is shown as follows:

Asbestos produced in the Union of South Africa, 1928 and 1929, by varieties

	1928		1929	
	Short tons	Value	Short tons	Value
Amosite (Transvaal)	6,748	£69,039	9,260	£98,241
Chrysotile (Transvaal)	12,162	214,866	17,724	247,817
Chrysotile (Natal)	------	------	23	340
Blue (Transvaal)	66	2,245	------	------
Blue (Cape)	5,078	113,400	6,030	150,995
	24,054	399,550	33,037	497,393

OTHER COUNTRIES

Australia.—About 300 metric tons of chrysotile asbestos, valued at about £15,000, was produced in Australia during 1929. It was obtained from the Lionel mines in the Soanesville district of Western Australia. It is reported that the East Rand Consolidated (Ltd.) now controls these mines.

Austria.—A short fiber known as microasbestos is mined in Austria, near the Hungarian frontier. It is used in both asphalt and concrete for road construction. No production figures are available. Austria has nine factories for the manufacture of asbestos goods, chiefly asbestos-cement tile and high-pressure packings.

China.—The Nippon Asbestos Co. has produced in a small way in Manchuria for about 20 years. The mines are about 5 miles from Chinchu. Production for 1928 is reported as 532 metric tons. The fiber is shipped to the company's factories at Osaka and Tokyo, Japan.

Cyprus.—The Island of Cyprus produces a short-fiber chrysotile asbestos that finds a ready market in Europe. During recent years the industry has made remarkable growth, but production receded somewhat in 1929 from the record figure of 1928. Production figures for recent years are given in the following table:

Asbestos produced in and exported from Cyprus, 1925–1929 [1]

Year	Production (long tons)	Exports	
		Long tons	Value
1925	3, 221	3, 290	£54, 639
1926	6, 197	6, 331	121, 857
1927	11, 200	10, 904	207, 562
1928	16, 287	11, 579	231, 692
1929	14, 110	[2] 13, 796	[2] 292, 971

[1] Figures supplied by the Cyprus Trading Corporation (Ltd.) unless otherwise indicated.
[2] Figures reported by Government of Cyprus.

France.—A great variety of asbestos products are made in France, including roofing tile, fabrics, boards, and packings.

Germany.—Germany has developed an important asbestos-product manufacturing industry, using Russian, South African, and Canadian fiber.

Italy.—Italian asbestos has a high reputation for quality. The mines of Lombardy have been worked in crude fashion by peasants, but a movement is now under way to consolidate them under one control. It is reported that British interests are acquiring some of the important deposits in Italy.

Russia.—Asbestos production reported for the fiscal year ended September 30, 1928, was 26,417 metric tons. No figures have been obtained for the fiscal year ended September, 1929, but the industry is gradually expanding and becoming increasingly important in world trade.

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BARITE AND BARIUM PRODUCTS[1]

By R. M. SANTMYERS and B. H. STODDARD[2]

CRUDE BARITE

SALES

The quantity of crude barite sold or used by producers during 1929 showed a slight increase over 1928 and represents the largest annual output ever recorded. The average value per ton f. o. b. mine of barite sold in 1929 likewise showed an increase over 1928, rising from $6.51 in 1928 to $6.67 in 1929.

Crude barite sold or used by producers in the United States, 1920–1929

Year	Short tons	Value f. o. b. at mine		Year	Short tons	Value f. o. b. at mine	
		Total	Average			Total	Average
1920	228,113	$2,142,464	$9.39	1925	228,063	$1,703,097	$7.47
1921	66,369	531,958	8.02	1926	237,875	1,773,293	7.45
1922	155,040	1,123,950	7.25	1927	254,265	1,670,878	6.57
1923	214,183	1,664,156	7.77	1928	269,544	1,754,924	6.51
1924	196,332	1,540,744	7.85	1929	277,269	1,850,706	6.67

Each producing State, with the exception of Georgia, showed an increase in output of crude barite in 1929 over 1928. California increased its sales of crude barite from 12,557 short tons, valued at $51,502, in 1928 to 24,701 tons, valued at $147,762, in 1929, or 97 per cent in quantity and 187 per cent in value; the average value per ton increased from $4.10 in 1928 to $5.98 in 1929, or 46 per cent. Missouri's sales of crude barite increased from 114,274 tons, valued at $810,203, in 1928 to 118,679 tons, valued at $880,319, in 1929, or 4 per cent in quantity and 9 per cent in value; the average value per ton increased from $7.09 in 1928 to $7.42 in 1929, or 5 per cent. Tennessee increased its sales of crude barite from 20,260 tons, valued at $150,937, in 1928 to 26,140 tons, valued at $181,725, in 1929, or 29 and 20 per cent, respectively; the average value per ton, however, decreased from $7.45 in 1928 to $6.95 in 1929, or 7 per cent. The sales of crude barite in Georgia showed a decrease of 16 per cent in quantity and 19 per cent in value—from 112,316 tons, valued at $675,509, in 1928 to 94,118 tons, valued at $546,212, in 1929; the average value per ton likewise decreased—from $6.01 in 1928 to $5.80 in 1929.

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[1] Work on manuscript completed September, 1930.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Crude barite sold or used by producers in the United States, 1928 and 1929, by States

State	1928				1929			
	Short tons	Percentage of total	Value f. o. b. at mine		Short tons	Percentage of total	Value f. o. b. at mine	
			Total	Average			Total	Average
California	12,557	5	$51,502	$4.10	24,701	8.9	$147,762	$5.98
Colorado	40		340	8.50				
Georgia	112,316	42	675,509	6.01	94,118	34.0	546,212	5.80
Missouri	114,274	42	810,203	7.09	118,679	42.8	880,319	7.42
Nevada					818	.3	6,384	7.80
Tennessee	20,260	7	150,937	7.45	26,140	9.4	181,725	6.95
Other States[1]	10,097	4	66,433	6.58	12,813	4.6	88,304	6.89
	269,544	100	1,754,924	6.51	277,269	100.0	1,850,706	6.67

[1] South Carolina, Virginia, and Wisconsin.

STOCKS AT MINES

The apparent stock of crude barite on hand at mines at the end of December, 1929, was about 17,000 short tons, of which about 6,000 tons was held in Georgia and about 8,000 tons in Missouri. The total represents a decrease of a little more than 50 per cent as compared with the apparent stock of crude barite on hand at the end of 1928. These stocks do not include the crude barite held at chemical, lithopone, and grinders' plants, as such lots are considered marketed product.

CONSUMPTION BY USES

Twenty-seven plants distributed among 12 States used 334,406 short tons of domestic and imported crude barite in 1929, compared with 25 plants in 11 States using 334,695 tons in 1928. Two new plants were put into operation—one each in California and Colorado. Illinois, with six plants, used 76,675 tons in the manufacture of lithopone and barium chemicals and was the largest consumer of crude barite in 1929, exceeding by 8,771 tons Missouri, with four plants. The barite consumed in Missouri was used in the manufacture of ground barite and barium chemicals. New Jersey, with 3 plants, used 55,738 tons in the manufacture of lithopone and chemicals; Pennsylvania, with 2 plants, consumed 54,440 tons in the manufacture of lithopone and chemicals; and California, with 5 plants, consumed 17,455 tons in the manufacture of ground barite, lithopone, and chemicals. All the imported crude barite was used in the Atlantic Coast States.

Crude barite (both domestic and imported) used in the manufacture of barium products in the United States, 1920–1929, in short tons

Year	In manufacture of—			Total	Year	In manufacture of—			Total
	Ground barite	Lithopone	Barium chemicals			Ground barite	Lithopone	Barium chemicals	
1920	79,052	113,181	37,210	229,443	1925	56,851	146,693	29,141	232,685
1921	28,296	61,359	10,952	100,607	1926	69,048	178,889	33,119	281,056
1922	48,280	94,259	25,303	167,842	1927	73,119	222,791	34,280	330,190
1923	47,713	128,547	34,327	210,587	1928	74,814	211,592	48,289	334,695
1924	42,855	137,127	33,181	213,163	1929	58,770	223,188	52,448	334,406

Domestic and imported crude barite used in the manufacture of barium products in the United States in 1929, by States

State	Product manufactured	Plants [1]	Barite used
			Short tons
Illinois	Lithopone and chemicals	6	76,675
Missouri	Ground barite and chemicals	4	67,904
New Jersey	Lithopone and chemicals	3	55,738
Pennsylvania	do	2	54,440
California	Ground barite, lithopone, and chemicals	5	17,455
Delaware and Maryland	Lithopone	2	62,194
Georgia	Ground barite	1	
New York	Chemicals	1	
South Carolina	Ground barite	1	
West Virginia	Chemicals	1	
Colorado	do	1	
		27	334,406

[1] A plant producing more than 1 product is counted but once in arriving at total.

IMPORTS

In 1929, as usual, crude barite from Germany accounted for the greater part of the total imports of this mineral into the United States. The imports of crude barite for consumption in 1929 showed an exceptionally large increase, and reached the highest figure ever recorded. They amounted to 85,729 short tons, valued at $284,436, as compared with 61,765 tons, valued at $190,756, in 1928, an increase of 39 per cent in quantity and 49 per cent in total value; the average declared value per ton at foreign port of shipment likewise increased—from $3.09 in 1928 to $3.32 in 1929.

Crude barite imported for consumption in the United States, 1920–1929

Year	Short tons	Value [1]	Year	Short tons	Value [1]
1920	24,874	$146,858	1925	28,655	$91,016
1921	11,054	59,371	1926	51,016	195,004
1922	23,239	104,680	1927	70,274	253,284
1923	15,045	93,721	1928	61,765	190,756
1924	21,502	104,264	1929	85,729	284,436

[1] Value at port of shipment, on which duty is levied. Does not include railroad and ship freight charges to this country or import duty.

WORLD PRODUCTION

The following table shows the output of barite by various countries from 1925 to 1929, as far as statistics are available.

World production of barite, 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Algeria	600	800	500	----------	1, 200
Australia:					
New South Wales	203	203	203	20	154
South Australia	2, 040	1, 770	1, 916	2, 404	2, 001
Tasmania	4	----------	----------	----------	10
Austria	1, 363	966	1, 924	2, 243	300
Belgium	13, 190	6, 100	1, 630	740	(1)
Canada	86	91	51	115	95
France	41, 450	38, 810	(1)	(1)	(1)
Germany:					
Bavaria	21, 477	26, 955	20, 035	23, 872	23, 406
Prussia	151, 243	135, 319	154, 794	232, 858	260, 811
Saxony	968	----------	----------	1, 401	(1)
Great Britain	49, 462	43, 462	47, 605	50, 702	58, 011
India (British)	1, 473	2, 348	1, 747	3, 146	3, 810
Italy	32, 195	31, 845	30, 677	27, 116	24, 100
Rhodesia, Southern	36	27	13	77	264
Russia [2]	4, 684	14, 389	8, 496	3, 476	(1)
Spain [3]	8, 784	7, 941	7, 716	6, 163	(1)
United States	206, 894	215, 795	230, 664	244, 525	251, 533

[1] Data not available.

[2] Year ended Sept. 30.

[3] Includes the following quantities reported produced from quarries: 1925, 78 tons; 1926, 690 tons; 1927, 2,760 tons; 1928, 2,300 tons.

BARIUM PRODUCTS

The total quantity of barium products manufactured and sold or used by producers was only slightly greater in 1929 than in 1928; the total value increased 3 per cent. Ground barite showed a loss of 15 per cent in quantity, lithopone an increase of 3 per cent, and barium chemicals an increase of 13 per cent; the corresponding changes in total value were as follows: Ground barite a decrease of 31 per cent; lithopone an increase of 4 per cent; and barium chemicals an increase of 21 per cent.

Barium products made from domestic and imported crude ores in the United States and sold or used by producers, 1928 and 1929

Product	1928			1929		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Ground barite	64, 425	$1, 332, 228	$20. 68	54, 472	$914, 516	$16. 79
Lithopone	200, 468	19, 073, 914	95. 15	206, 315	19, 773, 864	95. 84
Barium chemicals [1]	33, 969	2, 045, 156	----------	38, 438	2, 466, 305	----------
	298, 862	22, 451, 298	----------	299, 225	23, 154, 685	----------

[1] Barium chemicals manufactured from barium products bought in open market are not included in table in order to avoid duplication; the total output of barium chemicals is therefore not shown above.

REFINED GROUND BARITE

The total quantity of ground barite sold or used by producers during 1929 amounted to 54,472 short tons, valued at $914,516, a decrease of 15 per cent in quantity and 31 per cent in value as compared with 1928; the average value per ton likewise showed a decrease—from $20.68 in 1928 to $16.79 in 1929, or 19 per cent. Missouri continued to be the center of the grinding industry, using 50,720 short tons of crude barite for this purpose in 1929.

Ground barite sold or used by producers in the United States, 1920–1929

Year	Number of plants	Short tons	Value		Year	Number of plants	Short tons	Value	
			Total	Average				Total	Average
1920	8	65,748	$1,381,868	$21.02	1925	5	49,674	$1,040,461	$20.95
1921	7	27,661	622,871	22.52	1926	5	57,812	1,186,563	20.52
1922	7	46,176	933,722	20.22	1927	7	57,658	1,166,294	20.23
1923	6	39,605	895,095	22.60	1928	8	64,425	1,332,228	20.68
1924	5	38,296	784,881	20.50	1929	8	54,472	914,516	16.79

LITHOPONE

Lithopone manufacturers established a new high record in 1929 in quantity sold. The effect of the high prices in 1928 was carried over into 1929, and the regular lithopone market remained practically without change throughout the entire year. Closer integration of the manufacturing companies was one of the features of 1929 and was in a large way responsible for the absence of elements that usually disturb values.[3] Makers of commercial lithopone renewed their contract prices for 1930 and made preparations for additional interest in the product.

Twelve plants were in operation in 1929 and shipped 206,315 short tons of lithopone, valued at $19,773,864, an increase of 3 per cent in quantity and 4 per cent in value compared with 1928; the average value per ton increased slightly—from $95.15 in 1928 to $95.84 in 1929, or $0.69.

Lithopone sold or used by producers in the United States, 1920–1929

Year	Number of plants	Short tons	Value		Year	Number of plants	Short tons	Value	
			Total	Average				Total	Average
1920	17	89,373	$12,484,925	$139.69	1925	11	145,019	$15,186,147	$104.72
1921	15	55,016	6,681,563	121.45	1926	13	159,931	16,062,197	100.43
1922	13	83,360	9,214,040	110.53	1927	13	176,994	17,163,620	96.97
1923	11	98,199	11,608,443	118.21	1928	12	200,468	19,073,914	95.15
1924	11	109,469	12,531,397	114.47	1929	12	206,315	19,773,864	95.84

DISTRIBUTION OF LITHOPONE SALES

The following table shows the distribution of lithopone sales, by consuming industries. The paint, varnish, and lacquer industries consume by far the larger part of the lithopone sold; they purchased 150,804 short tons in 1929, or 73 per cent of the total sales. The floor covering and textile industries were the next largest consumers of lithopone, purchasing 37,506 tons, or 18 per cent of the total; the rubber industry purchased 7,176 tons, or 3.5 per cent; and other industries purchased 10,829 tons, or 5 per cent.

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[3] Oil, Paint and Drug Reporter, vol. 117, No. 6, Feb. 6, 1930, p. 89.

Lithopone sold or used by producers, 1927–1929, by consuming industries

Industry	1927		1928		1929	
	Short tons	Percentage of total	Short tons	Percentage of total	Short tons	Percentage of total
Paints, varnish, lacquers	131, 145	74. 1	149, 122	74. 4	150, 804	73. 1
Floor coverings and textiles	31, 186	17. 6	35, 416	17. 7	37, 506	18. 2
Rubber	7, 653	4. 3	6, 898	3. 4	7, 176	3. 5
Other	7, 010	4. 0	9, 032	4. 5	10, 829	5. 2
	176, 994	100. 0	200, 468	100. 0	206, 315	100. 0

GROWTH OF USE OF BARIUM PIGMENTS

The use of barium sulphate for the manufacture of lithopone is increasing rapidly. In 1918 the producers sold 62,403 short tons of lithopone. The amount sold increased annually until in 1921, when, as a result of business depression throughout the country, it fell to 55,016 tons; since then sales have advanced steadily, and 206,315 tons of lithopone was sold in 1929. Sales of barium sulphate as blanc fixe increased from 9,522 short tons in 1918 to 13,395 tons in 1927, the latest year for which the Bureau of Mines is at liberty to publish figures. Sales, however, continued to increase in 1928 and 1929.

Sales of zinc pigments have likewise showed increases in recent years, reaching 187,760 short tons in 1929, an increase of 1.4 per cent over 1928.

Sales of lead pigments, on the other hand, have fallen off in recent years, the decrease in 1929 being 4 per cent as compared with 1928 and 5 per cent as compared with 1927.

Barium, lead, and zinc pigments sold or used by producers in the United States, 1920–1929, in short tons

Year	Lithopone	Barium sulphate (blanc fixe)	Lead pigments [1]	Zinc pigments [2]
1920	89, 373	8, 046	158, 107	129, 904
1921	55, 016	2, 471	181, 851	90, 432
1922	83, 360	7, 349	208, 756	148, 078
1923	98, 199	6, 761	174, 822	150, 491
1924	109, 469	7, 796	202, 066	158, 199
1925	145, 019	11, 748	178, 901	183, 104
1926	159, 931	(3)	162, 084	170, 782
1927	176, 994	13, 395	171, 177	177, 310
1928	200, 468	(3)	169, 974	185, 127
1929	206, 315	(3)	162, 611	187, 760

[1] White lead (dry and in oil) and white lead sulphate.
[2] Zinc oxide and leaded zinc oxide.
[3] Bureau of Mines not at liberty to publish figures.

BARIUM CHEMICALS

In 1929 the total quantity of barium chemicals from barite sold or used by producers increased 13 per cent over that in 1928; the total value increased from $2,045,156 in 1928 to $2,466,305 in 1929, or 21 per cent. Sales of barium carbonate increased from 7,626 short tons, valued at $416,227, in 1928 to 7,902 tons, valued at $450,041, in 1929;

the average value per ton increased from $54.58 to $56.95. Sales of barium chloride increased from 5,224 tons, valued at $301,490, in 1928, to 6,545 tons, valued at $412,902, in 1929; the average value per ton increased from $57.71 to $63.09.

Barium chemicals sold or used by producers in the United States, 1928 and 1929

Chemical	1928			1929		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Barium carbonate	7,626	$416,227	$54.58	7,902	$450,041	$56.95
Barium chloride	5,224	301,490	57.71	6,545	412,902	63.09
Barium sulphate (blanc fixe)	21,119	1,327,439		23,991	1,603,362	
Other [1]						
	33,969	2,045,156		38,438	2,466,305	

[1] Binoxide, hydroxide, and sulphide.

Barium chemicals sold or used by producers in the United States, 1920–1929, in short tons

Year	Barium carbonate	Barium chloride	Barium sulphate (blanc fixe)	Other barium chemicals [1]	Year	Barium carbonate	Barium chloride	Barium sulphate (blanc fixe)	Other barium chemicals [1]
1920	7,484	3,084	8,046	2,146	1925	4,962	(2)	11,748	1,944
1921	1,956	(2)	2,471	1,060	1926	5,394	4,592	(2)	11,925
1922	2,281	2,022	7,349	2,249	1927	5,969	3,708	13,395	871
1923	6,362	3,301	6,761	379	1928	7,626	5,224	(2)	21,119
1924	6,058	3,859	7,796	441	1929	7,902	6,545	(2)	23,991

[1] Figures cover chemicals, as follows—1920: Binoxide, hydroxide, nitrate, and sulphide; 1921 and 1925: Chloride, hydroxide, and sulphide; 1922: Binoxide, hydroxide, sulphide, and sulphydrate; 1923–24: Hydroxide and sulphide; 1926: Hydroxide, sulphate, and sulphide; 1927: Binoxide, hydroxide, and sulphide; 1928–29: Binoxide, hydroxide, sulphate, and sulphide.

[2] Included under "Other barium chemicals."

IMPORTS AND EXPORTS

The imports of barium compounds, for consumption in the United States, with the exception of witherite (natural barium carbonate) and barium hydroxide, showed decreases in quantity in 1929 as compared with 1928. Following are the compounds imported and their increases or decreases: Ground barite, decrease of 6 per cent in quantity and increase of 4 per cent in value; lithopone, decrease of 15 per cent in quantity and 10 per cent in value; blanc fixe, decrease of 5 per cent in quantity and 0.3 per cent in value; witherite (natural barium carbonate), increase of 2 per cent in quantity and 21 per cent in value; artificial barium carbonate, decrease of 39 per cent in quantity and 40 per cent in value; barium binoxide, decrease of 99 per cent in quantity and 98 per cent in value; barium chloride, decrease of 93 per cent in quantity and 88 per cent in value; barium nitrate, decrease of 22 per cent in quantity and 18 per cent in value; and barium hydroxide, increase of 9 per cent in quantity and 18 per cent in value.

Barium compounds imported for consumption in the United States, 1921–1929

[Value at port of shipment]

Year	Ground barite		Lithopone		Barium binoxide		Blanc fixe (precipitated barium sulphate)		Artificial barium carbonate (chemically precipitated)	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	1,002	$16,942	5,247	$432,019	669	$127,631	769	$22,470	2,238	$80,603
1922	4,696	59,453	10,763	885,671	1,009	189,334	2,187	76,445	5,212	210,250
1923	6,022	88,741	10,440	776,383	905	152,270	587	32,063	1,901	79,482
1924	2,830	38,292	6,830	543,025	860	120,374	1,047	50,465	3,752	128,217
1925	3,203	40,008	6,330	478,395	635	70,553	1,996	81,439	7,188	160,164
1926	3,347	44,781	8,686	661,700	49	8,157	2,973	136,697	9,224	189,167
1927	3,259	38,568	7,979	656,166	6	1,264	2,400	107,179	4,918	119,014
1928	3,098	33,378	9,885	808,200	6	1,310	3,680	168,923	5,222	116,241
1929	2,924	34,619	8,409	725,554	(1)	21	3,501	168,367	3,206	69,236

Year	Natural barium carbonate (ground witherite)		Barium chloride		Barium nitrate		Barium hydroxide	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1921	668	$25,188	2,186	$72,621	(2)	(2)	(2)	(2)
1922	1,472	39,114	1,962	112,785	[3] 179	[3] $16,795	[3] 73	[3] $6,573
1923	1,557	41,823	1,278	75,014	511	59,766	181	16,872
1924	2,500	56,415	2,330	100,810	513	54,638	174	8,241
1925	2,390	63,634	2,167	67,306	703	58,192	120	5,605
1926	3,380	80,679	1,773	49,426	602	49,494	236	9,789
1927	3,300	65,821	1,577	45,285	711	65,284	222	12,439
1928	4,311	82,434	1,172	25,253	789	69,010	186	10,031
1929	4,376	99,335	78	3,049	615	56,770	202	11,809

[1] 133 pounds.
[2] Not separately recorded prior to the tariff of Sept. 22, 1922.
[3] Sept. 22 to Dec. 31.

Exports of lithopone increased from 3,326 short tons, valued at $337,565, in 1928 to 4,556 tons, valued at $463,235, in 1929; the average value per ton increased from $101.49 in 1928 to $101.68 in 1929.

Lithopone exported from the United States, 1922–1929 [1]

Year	Short tons	Value	
		Total	Average
1922	1,616	$169,982	$105.19
1923	1,485	176,624	118.94
1924	923	104,783	113.52
1925	1,287	132,771	103.16
1926	1,941	$200,412	$103.25
1927	2,110	222,585	105.49
1928	3,326	337,565	101.49
1929	4,556	463,235	101.68

[1] Not separately recorded prior to 1922.

PRICES

The accompanying table gives the range of quotations on barite and the barium products, 1927 to 1929. Quotations on crude barite are taken from the Engineering and Mining Journal and represent prices in Missouri. Quotations on ground barite are taken from the Oil, Paint and Drug Reporter and represent prices at St. Louis; quotations on lithopone and barium chemicals are taken from the same source and represent prices at New York.

Range of quotations on barite and barium products, 1927–1929

	Unit	1927	1928	1929
Crude barite	Short ton	$8.00	$6.50 –$7.50	$7.00–$8.00
Ground barite	do	23.00	23.00	23.00
Lithopone	Pound	.05⅜	.05¼	.05¼
Barium carbonate	Short ton	$48.00 –54.00	47.50 –60.00	57.50–60.00
Barium chlorate	Pound	.14 – .15	.14 – .15	.14– .15
Barium chloride	Short ton	50.00 –61.00	48.00 –63.00	63.00–65.00
Barium nitrate	Pound	.07½– .10	.08¼– .08½	.08– .08½
Barium sulphate (blanc fixe), dry	do	.04 – .04¼	.03½– .04¼	.03¾
Barium sulphate (blanc fixe), pulp	Short ton	60.00 –65.00	40.00 –60.00	42.50–45.00

The following are the designations on which quotations in the preceding table are based:

Crude barite, "f. o. b. mines."
Ground barite, "domestic, including barrels, f. o. b. St. Louis."
Lithopone, "in barrels, c. l."
Barium carbonate, "bags, works."
Barium chlorate, "kegs."
Barium chloride, "crystals, bags, works."
Barium nitrate, "casks."
Barium sulphate (blanc fixe), "dry, in barrels, c. l., f. o. b. works."
Barium sulphate (blanc fixe), "pulp, works."

PRODUCERS

Producers of barium products in the United States active in 1929 are listed below, with the addresses of their main offices and the locations of their plants.

Ground barite:	
Chemical & Pigment Co. (Inc.) (grinding plant), Oakland, Calif.	Oakland, Calif.
Clinchfield Sand & Feldspar Co., Baltimore, Md	Kings Creek, S. C.
C. P. De Lore Co., St. Louis, Mo	St. Louis, Mo.
Flynt Silica & Spar Co., Los Angeles, Calif	Los Angeles, Calif.
Los Angeles Chemical Co., Los Angeles, Calif	South Gate, Calif.
National Pigments & Chemical Co., St. Louis, Mo	Adelbert and St. Louis, Mo.
Thompson, Weinman & Co. (Inc.), Cartersville, Ga	Cartersville, Ga.
Lithopone:	
Chemical & Pigment Co. (Inc.) (lithopone plant), Oakland, Calif.	Oakland, Calif.
Do	Collinsville, Ill.
Do	St. Helena, Md.
Eagle-Picher Lead Co., Chicago, Ill	Argo, Ill.
Grasselli Chemical Co., Cleveland, Ohio	Grasselli, N. J.
Do	Newark, N. J.
Do	Philadelphia, Pa.
Krebs Pigment & Chemical Co., Newport, Del	Newport, Del.
Mineral Point Zinc Co., care New Jersey Zinc Co., New York, N. Y.	Depue, Ill.
New Jersey Zinc Co. (of Pennsylvania), New York, N. Y.	Palmerton, Pa.
Sherwin-Williams Co., Cleveland, Ohio	Chicago, Ill.
United Color & Pigment Co., Newark, N. J	Newark, N. J.

Barium chemicals:[4]

Alton Barium Products Co., Alton, Ill	Alton, Ill.
Barium Products (Ltd.), Modesto, Calif	Modesto, Calif.
Barium Reduction Corporation & Barium Mining Corporation, Charleston, W. Va.	Charleston, W. Va.
Chicago Copper & Chemical Co., Chicago, Ill	Blue Island, Ill.
Grasselli Chemical Co., Cleveland, Ohio	Philadelphia, Pa.
Great Western Sugar Co., Denver, Colo	Johnstown, Colo.
Oakland Chemical Co., New York, N. Y	New York, N. Y.
Titanium Pigment Co. (Inc.), St. Louis, Mo	Carondelet Station, St. Louis, Mo.

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[4] Includes only those using barite.

TALC AND SOAPSTONE[1]

By Oliver Bowles and B. H. Stoddard[2]

INTRODUCTION

Conditions prevailing in the talc industry in 1929 were as a whole slightly above normal. The general trend of recent years toward increased production and sales was maintained, the total domestic tonnage sold reaching the highest figure since 1924. The steady growth of the industry is due largely to the broadening of the uses of the material, and the outlook for continued expansion is said to be encouraging. Little change occurred in the general level of prices during the year, the natural effect of active competition being a slight decline. The active demand for talc is also reflected in increased imports—15 per cent in quantity and 16 per cent in value—as compared with 1928. The total quantity and value of the imports in 1929 were the largest ever recorded.

PRODUCTION

The total talc sold by producers in the United States in 1929 was 219,783 short tons, valued at $2,628,662, an increase of 8 per cent in quantity and 4 per cent in value as compared with 1928. The figures comprise 11,228 tons of crude talc, valued at $87,820; 473 tons of sawed and manufactured talc, valued at $140,928; and 208,082 tons of ground talc, valued at $2,399,914. Of the total sales New York supplied 109,543 tons, valued at $1,439,272; Vermont 60,469 tons, valued at $546,658; California 17,620 tons, valued at $256,977; and the remaining States, Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, and Wisconsin, 32,151 tons, valued at $385,755.

Sales of talc and soapstone by producers over a series of years are shown in the following table.

Talc and soapstone sold by producers in the United States, 1920–1929, by classes

Year	Crude		Sawed and manufactured				Ground		Total	
			Talc		Soapstone					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	11,008	$43,820	1,415	$139,335	19,707	$709,400	178,505	$2,142,894	210,635	$3,035,449
1921	2,150	12,911	([a])	([a])	[a]17,423	[a] 627,826	102,413	1,115,205	121,986	1,755,942
1922	4,981	22,582	654	86,333	22,700	712,144	170,349	2,038,838	198,684	2,859,897
1923	5,706	50,125	682	114,772	22,857	932,098	167,447	1,915,258	196,692	3,012,253
1924	5,710	22,247	846	109,405	25,630	1,288,885	171,635	2,095,019	203,821	3,515,556
1925 [b]	5,684	24,533	895	107,691	([c])	([c])	175,677	1,879,569	182,256	2,011,793
1926 [b]	5,988	26,723	1,528	130,253	([c])	([c])	174,052	1,954,018	181,568	2,110,994
1927 [b]	5,706	25,365	1,494	111,650	([c])	([c])	185,116	2,097,709	192,316	2,234,724
1928 [b]	6,360	48,031	936	70,394	([c])	([c])	195,680	2,419,569	202,976	2,537,994
1929 [b]	11,228	87,820	473	140,928	([c])	([c])	208,082	2,399,914	219,783	2,628,662

[a] Talc included under "Soapstone."
[b] Figures represent talc only.
[c] Bureau of Mines not at liberty to publish figures for soapstone.

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[1] Work on manuscript completed October, 1930.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Talc sold by producers in the United States, 1927–1929, by classes

Form in which sold	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Rough (crude)	5,706	$25,365	6,360	$48,031	11,228	$87,820
Sawed and manufactured [1]	1,494	111,650	936	70,394	473	140,928
Ground [2]	185,116	2,097,709	195,680	2,419,569	208,082	2,399,914
	192,316	2,234,724	202,976	2,537,994	219,783	2,628,662

[1] For slate pencils and metal-worker's crayons and for blanks used in making acetylene burners and other objects.

[2] For filler in paper, paint, and rubber goods, and for toilet powder, foundry facings, textiles, lubricators, electric insulation, etc.

COMPOSITION AND PROPERTIES

Pure talc is a distinct mineral, a hydrous magnesium silicate, having a chemical composition represented by the formula $H_2Mg_3(SiO_3)_4$. It contains 31.7 per cent of magnesia (MgO), 63.5 per cent of silica (SiO_2), and 4.8 per cent of water (H_2O). Commercial talc is rarely pure, as it contains varying quantities of clay, iron oxide, silica, calcite, and dolomite, together with sodium and potassium compounds. It occurs in fine granular, flaky, and, occasionally, fibrous form.

Its most pronounced and most easily recognizable physical properties are its softness, being easily scratched with the finger nail, and its soapy feel. It has superior properties of resisting and retaining heat, and it is also very resistant to the action of practically all acids and alkalies. It has high dielectric strength and is colloidal in finely ground form. It ranges in color from pure white through various shades of gray, green, and yellow.

The mineral pyrophyllite, a hydrous silicate of aluminum having the chemical formula $H_2Al_2(SiO_3)_4$, closely resembles talc in color, luster, and feel and is employed as a substitute for talc in many uses. It may, in fact, be superior to talc for some applications. It is claimed, for example, that it is better than talc as an admixture in plaster of Paris. The efflorescent stains on the surface of the plaster are commonly attributed to the presence of magnesium salts, and talc, being a magnesium silicate, might provide material for such salts. Pyrophyllite, having physical properties similar to those of talc, will condition and improve the working qualities of the plaster in much the same way as does talc, and, as pyrophyllite is an aluminum silicate, it will supply no magnesium.

USES

Dependence of use on physical properties.—The uses of talc and soapstone are governed to a greater extent by their characteristic physical properties than by their chemical composition. Thus the colloidal nature of finely ground talc makes it valuable as a filler in paper and other products, and its soft, soapy feel makes it useful for the manufacture of toilet powders and cosmetics. The high electrical resistance of massive talc has led to its use in various electrical appliances. The heat resistance of soapstone renders it suitable for the manufacture of fireless cookers and linings for fireplaces, and its acid resistance is favorable to its use as acid-tank lining. Its easy workability adapts it to shaping into laundry tubs, sinks, and laboratory-table tops.

These are some of the more obvious ways in which physical characteristics adapt talc and soapstone to specific uses. As the use depends largely on the physical properties, it is evident that a detailed knowledge of the properties of various talcs is essential to obtaining the best possible service from them. Ignorance of the physical properties of a talc may lead to attempts to use it for purposes to which it is not adapted, resulting in damage to its prestige as a raw material. The more progressive talc producers realize that scientific research and standardization are necessary steps toward better utilization and consequent widening of market demands. Research should cover such properties as hardness, color, grain size, grain shape, slip, specific gravity, absorption, electrical resistance, and behavior under heat.

Uses enumerated.—High-grade ground talc is used extensively as a filler in paper, paint, rubber, textiles, and various other products; it is also used for foundry facings, lubricants, and various toilet preparations (such as talcum powder), in glass making, as a polishing agent for peanuts and rice, and in the manufacture of crayons and pencils. Large quantities of low-grade talc are used in the manufacture of composition roofing, both as a surface material to increase weather-resisting qualities and as a nonadhesive coating to prevent sticking; it is also used to prevent the sticking of rubber compounds to hot rollers.

High-grade massive talc of the variety known as "lava" grade, free from iron oxide and grit and without cracks or cleavage planes, is cut into gas tips, blanks for electric insulators, and spark plugs. The forms, easily shaped in the soft state in which massive talc is found in nature, are heated to a temperature of about 1,100° C. Such calcination has the peculiar effect of rendering the products hard enough to cut glass, and yet the expansion, contraction, or distortion resulting from the heating and subsequent cooling are so minute that the shapes, sizes, and even the accuracy of the milling remain unimpaired. Talc of this grade thus possesses a combination of qualities rarely found, namely, high dielectric strength, easy workability in the natural state, and an easily attained high degree of hardness without distortion on heating. High-grade massive talc is finding wider use for high-tension electrical insulators. Special interest has been shown in this application in England.

Massive soapstone is manufactured into laundry tubs, trays, sinks, laboratory-table tops, store fronts, bus-bar compartments, electric insulating material, acid tanks, stair treads, furnace blocks, fuze guards, tiles, aquariums, switchboards, panel boards, bases, insulators, wainscoting, fireless-cooker stones, hearth linings, furnace linings, and griddles.

Some progress has been made in extending the uses for talc and soapstone. Soapstone granules may be hardened by heat treatment to render them suitable for surfacing prepared roofing. Ground talc or soapstone, even if quite impure, is found to be suitable for dusting coal mines to prevent dust explosions, and increasing amounts are being sold for this purpose. Ground talc and soapstone are also being used as admixtures for conditioning concrete to increase its workability, strength, and water resistance.

PRICES

The highest-priced talc is that manufactured into crayons, pencils, and blanks for insulators and gas burners. In 1929, in crude form it was quoted at $63 a ton and in manufactured form as high as $800 a ton. The highest market quotation for ground talc was $30 a ton (container included) for the high-grade toilet-powder material from California. The price of the best grade of ground fibrous talc from New York (325-mesh, container included) held at $14.75 a ton for most of the year, although it reached as high as $16.50; the nonfibrous type from Natural Bridge, N. Y., was quoted at $12 to $15 a ton. Finely ground talc from Vermont ranged from $7 to $10 a ton (container included). Market quotations for crude material from Georgia were $4 to $5 a ton; for ground talc (roofing grade), from $7.50 to $9 a ton; and for other ground material, from $7 to $15 a ton (container included). Prices for pencils and steel crayons ranged from 50 cents to $3 a gross. Maryland crude was quoted at $4 a ton; high-grade crude (refractory material) brought $63 a ton; ground material, $14 a ton; and cubes, blanks, and other forms, 10 cents a pound. Prices of ground talc from New Jersey ranged from $10 to $12 (container included). Crude material from Virginia brought $3.50 to $4.50 a ton, and powdered talc was quoted at $6.25 to $14.50 a ton.

REVIEW BY STATES

Talc is mined chiefly in New York and Vermont, and these two States produced more than 75 per cent of the total quantity in 1929. Smaller quantities were mined in 1929 in California, Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, and Wisconsin.

The following table gives the quantity and value of the talc sold by producers in the various States in the past three years.

Talc sold by producers in the United States, 1927–1929, by States

State	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
California	15,760	$238,755	17,830	$271,413	17,620	$256,977
Georgia	3,110	42,370	(1)	(1)	4,989	146,025
Maryland	(1)	(1)	(1)	(1)	(1)	(1)
New Jersey[2] and Pennsylvania	(1)	(1)	(1)	(1)	(1)	(1)
New York	94,553	1,191,453	107,321	1,504,103	109,543	1,439,272
North Carolina	(1)	(1)	(1)	(1)	9,439	81,306
Vermont	54,688	503,716	52,125	502,501	60,469	546,658
Virginia	(1)	(1)	3,997	37,993	5,185	47,646
Wisconsin					4,350	14,238
Undistributed	24,205	258,430	21,703	221,984	8,188	96,540
	192,316	2,234,724	202,976	2,537,994	219,783	2,628,662

[1] Included under "Undistributed."

[2] No production from New Jersey in 1928.

California.—In 1929 the talc industry in California remained virtually as it was in 1928, although slight decreases were recorded in both quantity and value of talc sold. The sales, made by six producers, consisted almost entirely of high-grade talc from Inyo and San Bernardino Counties, used principally in the manufacture of toilet powder, although some was utilized in the paint and rubber trade, as a filler in bleacheries, and in the insulation of underground conduits.

Georgia.—Two companies in Georgia—the Cohutta Talc Co., Dalton, and the Georgia Talc Co., Asheville, N. C.—produced all the talc sold by producers in the State in 1929. The mines of these companies are a few miles southeast of Chatsworth, Murray County, and produce grades of talc that are used in the manufacture of crayons or pencils and in the rubber industry. Although the quantity of talc produced for the manufacture of crayons was only about one-eleventh as large as the production of ground talc, the value was almost five times as great.

Maryland.—Two companies were active in Maryland in 1929—the Harford Talc Co., of Baltimore, and Herbert I. Oursler, of Marriottsville. The massive talc produced by the Harford Talc Co. is sufficiently pure and fine grained to be of a refractory character and consequently is utilized in the manufacture of lava tips for gas burners. The product of the Oursler property near Henryton, Carroll County, is an impure talc schist used principally for foundry facings.

New Jersey and Pennsylvania.—In the New Jersey-Pennsylvania field, which lies on both sides of the Delaware River, operations were continued by the Rock Products Co., at Phillipsburg, N. J., and by C. K. Williams & Co., at Easton, Pa. The New Jersey talc was sold in crude form, as the mill of the company was not operated. The talc from Pennsylvania was all sold in ground form.

New York.—In 1929 the talc industry in New York showed little change. There was a slight increase in the quantity sold but a decrease in the value. New York, as usual, outranked all other States, contributing 50 per cent of the total sales for the year. All of the product was sold in ground form at an average value of $13.14 a ton. Two types of talc are mined in this region—the fibrous talc of the Gouverneur district, mined by the International Pulp Co., 41 Park Row, New York City, and the W. H. Loomis Talc Corporation, 173 East Main Street, Gouverneur, and the nonfibrous talc of Natural Bridge, mined by the Carbola Chemical Co. (Inc.), Natural Bridge. The fibrous variety is used extensively in the manufacture of paper; it is also used in the paint and rubber industries and as an aggregate for concrete. The nonfibrous material from Natural Bridge, which is associated with serpentine and limestone, is ground and used in making mineral paint or whitewash which can be applied as a dry powder or mixed with water in the usual way. These three companies are the largest producers of ground talc in the United States; consequently, their influence is dominant.

North Carolina.—In 1929 sales of talc and pyrophyllite by producers in North Carolina increased in both quantity and value as compared with 1928. All the material was sold in ground form at an average value of $8.61 a ton. Sales of pyrophyllite, which has characteristics and uses similar to those of talc, constituted more than 95 per cent of the total output of the State. There were two producers of pyrophyllite, one of them, the Tallassee Power Co., 2400 Oliver Building, Pittsburgh, Pa., a new operator, and one producer (new) of talc, the Binney & Smith Co., Murphy. The Standard Mineral Co. (Inc.), 50 East Forty-second Street, New York City, mined pyrophyllite, as usual, at its property near Hemp, Moore County.

Vermont.—Three producers in Vermont, the same as those in 1928, sold 60,469 tons of talc, valued at $546,658, in 1929, or 28 per cent of the total quantity sold by producers in the United States during the year and an increase of 16 per cent in quantity and 9 per cent in value as compared with 1928. Almost all of the product was sold in ground form at an average value of $8.71 a ton; a small quantity, however, was sold at a much higher price for the manufacture of crayons.

Virginia.—In 1929, as in 1928, talc sales in Virginia were made by the following producers: The Blue Ridge Talc Co. (Inc.), the Bull Run Talc & Soapstone Co. (Inc.), and the Old Dominion Soapstone Co. The total output increased 30 per cent in quantity and 25 per cent in value as compared with 1928, and was sold in ground form at an average value of $9.19 a ton. The greater part of the talc and soapstone output in Virginia is soapstone produced by the Virginia Alberene Corporation, whose output is manufactured largely into tubs, sinks, slabs for laboratory tables, and other forms.

Wisconsin.—The only talc operator in Wisconsin was the American Talc Co., Plymouth, which reported sales from its property near Milladore, Wood County, in 1929 for the first time. The talc is off color, but it has good slip and finds a market as a coating in the roofing industry; it is used also for foundry facings. The product was all sold in crude form.

LIST OF PRODUCERS

Producers of talc and soapstone in the United States in 1929

Name and address	Location of mine
CALIFORNIA	
American Italian Talc Co., 1407 East Sixth Street, Los Angeles.	9 miles west of Bigpine, Inyo County.
California Talc Co., 837 Jackson Street, Los Angeles	Near Shoshone, Inyo County.
W. S. McLean, 1919 San Bruno Avenue, San Francisco	Butte County.
Pacific Coast Talc Co., 2149 Bay Street, Los Angeles	7 miles north of Silver Lake station, San Bernardino County.
Sierra Talc Co., 428 Union League Building, Los Angeles.	Near Darwin, Inyo County.
Western Talc & Magnesite Co., 1901 East Slauson Avenue, Los Angeles.	Tecopa, Inyo County.
GEORGIA	
Cohutta Talc Co., Dalton	Chatsworth, Murray County.
Georgia Talc Co., Asheville, N. C	Foot of Cohutta Mountain, 3¼ miles southeast of Chatsworth, Murray County.
MARYLAND	
Harford Talc Co. (Inc.), 815 Continental Building, Baltimore.	Near Dublin, Harford County.
Herbert I. Oursler, Marriottsville	Near Henryton, Carroll County.
NEW JERSEY	
Rock Products Co., 403 Trust Building, Easton, Pa	Above Marble Hill, on Delaware River, near Phillipsburg, Warren County.
NEW YORK	
Carbola Chemical Co. (Inc.), Natural Bridge	1¼ miles from Natural Bridge, Lewis County.
International Pulp Co., 41 Park Row, New York City	Talcville, St. Lawrence County.
W. H. Loomis Talc Corporation, 173 East Main Street, Gouverneur.	Fowler, St. Lawrence County.

Producers of talc and soapstone in the United States in 1929—Continued

Name and address	Location of mine
NORTH CAROLINA	
Binney & Smith Co., Murphy	Near Murphy, Cherokee County.
Standard Mineral Co. (Inc.), 50 East Forty-second Street, New York, N. Y.	2½ miles from Hemp, Moore County.
Tallassee Power Co., 2400 Oliver Building, Pittsburgh, Pa.	Liberty, Randolph County.
PENNSYLVANIA	
C. K. Williams & Co., 640 North Thirteenth Street, Easton.	Near Easton, Northampton County.
VERMONT	
American Soapstone Finish Co. (Inc.), Chester	2½ miles from Chester, Windsor County.
Eastern Magnesia Talc Co. (Inc.), Burlington	Johnson, Lamoille County, and Waterbury, Washington County.
Vermont Talc Co., Chester	Windham, Windham County.
VIRGINIA	
Blue Ridge Talc Co. (Inc.), Henry	Near Henry station, Franklin County.
Bull Run Talc & Soapstone Co. (Inc.), Clifton Station	3 miles north of Clifton, Fairfax County.
Old Dominion Soapstone Co., 815 Continental Building, Baltimore, Md.	Near Clifton, Fairfax County.
Virginia Alberene Corporation, 153 West Twenty-third Street, New York, N. Y.	Schuyler, Nelson County.
WISCONSIN	
American Talc Co., Plymouth	Milladore, Wood County.

IMPORTS AND EXPORTS

Talc imported for consumption in the United States, 1920–1929

Year	Crude and unground steatite and French chalk		Manufactures (except toilet preparations) wholly or partly finished[1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	941	$7,206	21,739	$443,514	22,680	$450,720
1921	153	2,279	11,468	239,469	11,621	241,748
1922	248	9,850	18,196	367,528	18,444	377,378
1923	560	20,653	19,405	402,238	19,965	422,891
1924	313	4,847	17,496	337,508	17,809	342,355
1925	121	6,547	20,872	443,985	20,993	450,532
1926	199	16,366	23,642	523,716	23,841	540,082
1927	377	27,326	24,817	523,056	25,194	550,382
1928	459	33,276	26,590	546,639	27,049	579,915
1929	1,228	74,840	29,949	596,789	31,177	671,629

[1] Prior to Sept. 22, 1922, the classification was "Talc, steatite, and French chalk—cut, ground, or washed."

Talc, ground or unground, imported into the United States, 1928 and 1929, by countries

[General imports]

Country	1928		1929	
	Short tons	Value	Short tons	Value
Africa:				
British—Union of South Africa			54	$1,618
Portuguese—Mozambique			70	1,463
Austria	76	$2,000	116	3,376
Belgium	430	2,582	55	243
Canada	9,761	118,558	10,482	125,893
China	121	63,857	168	68,518
Cuba			(1)	6
Czechoslovakia	111	2,198		
France	7,605	100,564	10,401	127,439
Germany	144	4,776	150	2,373
Hong Kong	(1)	317	(1)	30
India (British)	126	3,217	673	35,084
Italy	8,535	270,301	8,819	292,106
Japan	3	4,288	24	3,584
Kwantung			1	30
Netherlands	30	918		
Philippine Islands			(1)	7
Soviet Russia in Europe			34	724
Spain	43	1,439	59	1,720
United Kingdom	23	1,439	141	7,096
	27,008	576,454	31,247	671,310

[1] Less than 1 ton.

Exports of talc in bulk are not recorded. The exports of "talcum and other toilet powders" in 1922 amounted to 1,821 short tons, valued at $1,397,542; in 1923, 1,907 tons, valued at $1,671,588; in 1924, 1,614 tons, valued at $1,688,211; in 1925, 1,734 tons, valued at $1,882,196; in 1926, 1,645 tons, valued at $1,726,933; in 1927, 1,627 tons, valued at $1,621,068; and in 1928, 1,568 tons, valued at $1,605,630. Exports of "powders—talcum, face, compact, and bath and other toilet powders" in 1929 were valued at $1,592,301; quantity not recorded. Similar exports were not separately classified prior to 1922.

TARIFF

The import duty on talc and steatite or soapstone, as fixed by the tariff act of 1930, paragraph 209, is as follows:

> Talc, steatite or soapstone, and French chalk, crude and unground, one-fourth of 1 cent per pound; ground, washed, powdered, or pulverized (except toilet preparations), 35 per centum ad valorem; cut or sawed, or in blanks, crayons, cubes, disks, or other forms, 1 cent per pound; manufactures (except toilet preparations), of which talc, steatite or soapstone, or French chalk is the component material of chief value, wholly or partly finished, and not specially provided for, if not decorated, 35 per centum ad valorem; if decorated, 45 per centum ad valorem.

WORLD PRODUCTION

The following table gives the world production of talc and soapstone from 1925 to 1929, so far as figures are available. The relative importance of the various countries as producers may vary from year to year, but in recent years the United States has produced from 42 to 50 per cent, France 18 to 20 per cent, Italy 8 to 12 per cent, Germany and Austria 3 to 5 per cent, and Canada 2 to 4 per cent of the total world's output. The remainder is widely distributed among many countries.

World production of talc and soapstone, 1925–1929, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
Australia:					
New South Wales	711	366	488	674	555
South Australia	358	560	629	641	776
Tasmania	----------	----------	----------	32	23
Austria (exports)	12,883	13,846	17,135	19,755	19,603
Canada	13,131	14,304	14,988	[2] 13,540	[2] 14,069
China [3]	31,516	(4)	23,000	(4)	(4)
Finland	----------	----------	1,050	4,725	2,848
France	69,350	75,740	75,600	(4)	(4)
Germany (Bavaria)	3,461	3,834	6,381	7,872	6,805
Great Britain	----------	----------	----------	164	29
Greece	94	151	213	30	(4)
India (British)	8,662	9,829	5,134	5,628	7,333
Italy	33,662	43,075	32,940	33,030	34,600
Japan [5]	44,094	(4)	59,947	(4)	(4)
Norway	9,032	7,608	7,607	7,822	(4)
Rumania	122	488	1,138	2,164	1,077
Russia [6]	569	2,995	2,118	2,761	(4)
Spain	1,771	1,658	3,843	5,302	5,164
Sweden	[7] 2,374	[7] 3,221	3,475	4,876	7,026
Union of South Africa (Transvaal)	60	76	307	541	464
United States [8]	165,339	164,715	174,465	184,136	199,383
Uruguay (exports)	913	897	36	985	786

[1] In addition to the countries listed, Argentina and Brazil produce a small quantity of talc. No data of production are available. Rail and river shipments in Argentina for 1928 were reported as 440 kilograms. Exports from Brazil for 1925 were reported as 158 kilograms; no exports are reported for later years.

[2] Exclusive of soapstone for which value only is given.

[3] Talc only. Estimated production (China, Geol. Survey Special Report).

[4] Data not available.

[5] Includes agalmatolite.

[6] Year ended Sept. 30.

[7] Exclusive of a small quantity for which value only is given.

[8] Figures represent talc only. Bureau of Mines not at liberty to publish figures for soapstone.

STONE[1]

By A. T. Coons

SUMMARY OF PRODUCTION

The total stone sold or used by the producers in the United States in 1929 amounted to 141,109,580 short tons, valued at $202,692,762. This was an increase of 5 per cent in quantity and 3 per cent in value from the output in 1928. Granite, limestone, sandstone, and "other stone" increased in both quantity and value. Marble decreased in quantity but increased in value. Basalt was the only variety of stone that decreased in both quantity and value.

The tables in this report give the quantities sold or used by producers and the values f. o. b. at quarries and mills, so far as these are obtainable. Stone quarried and used by the producer is considered as sold and is included in the figures given for sales. The figures do not, however, include the stone made into abrasives (such as grindstones, etc.), glass sand, lime, or cement and reported in terms of finished product. These products are treated in the Mineral Resources chapters on abrasives, sand and gravel, lime, and cement. An estimate of the total amount of limestone used for all purposes is given on page 254.

Stone sold or used by producers in the United States, 1920–1929, by kinds

[Quantities approximate]

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	4,760,000	$24,954,908	9,219,200	$12,260,148	431,500	$11,069,585	59,290,000	$75,655,260
1921	4,752,180	20,592,217	8,524,480	11,450,899	315,400	8,580,416	45,621,000	57,749,594
1922	5,913,120	21,125,869	10,032,900	12,600,611	427,870	10,534,671	58,928,660	68,397,927
1923	7,300,130	29,704,796	10,674,470	13,539,648	562,560	12,863,974	76,701,360	89,620,007
1924	6,883,860	28,772,161	11,671,500	14,679,523	516,000	13,302,235	75,894,430	89,868,956
1925	8,074,200	30,531,347	11,842,110	14,770,042	564,150	13,882,457	85,649,440	98,008,028
1926	9,330,390	32,044,523	12,977,740	15,950,302	563,170	14,167,480	91,887,900	109,252,299
1927	10,706,740	35,287,206	13,210,570	17,399,949	600,060	15,625,872	99,662,270	112,439,824
1928	9,556,500	33,994,527	15,327,760	19,693,945	579,490	16,402,986	96,864,650	110,231,974
1929	10,826,730	34,225,110	14,871,780	18,946,197	553,660	16,545,312	100,686,960	113,906,071

Year	Sandstone		Other stone[a]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	3,343,000	$7,310,290	1,483,300	$2,291,769	78,527,000	$133,541,960
1921	2,640,460	6,425,339	1,685,220	2,163,801	63,538,740	106,962,266
1922	3,388,130	7,521,044	1,520,880	1,886,806	80,211,560	122,066,928
1923	4,349,270	9,174,706	3,730,870	4,567,110	103,318,660	159,470,241
1924	3,894,690	10,142,099	4,323,640	5,105,139	103,184,120	161,870,113
1925	4,479,330	10,920,016	5,242,140	6,104,902	115,851,370	174,216,792
1926	4,978,530	11,149,029	4,758,630	5,744,957	124,496,360	188,308,590
1927	5,050,600	10,923,035	7,114,890	6,971,336	136,345,130	198,647,222
1928	4,716,530	10,498,440	6,824,580	5,998,825	133,869,510	196,820,697
1929	5,790,200	11,023,981	8,380,250	8,046,091	141,109,580	202,692,762

[a] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

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[1] Work on manuscript completed September, 1930.

Although the output of all the important stone products except paving blocks and curbstone increased and the total output of stone was the largest ever recorded, demand was not particularly active for any class of stone. The large increase in stone sold for "other uses" was due chiefly to a local condition in which a large quantity of stone was used for fill in a rock dam. Stone for use in such manufacturing industries as metallurgy, refractories, alkali, carbide, and other chemical industries increased, as did agricultural limestone. Crushed stone, which represented 66 per cent of the total stone output in 1929, increased 1.6 per cent in quantity compared with 1928, following a decrease of 4 per cent from 1927 to 1928. Stone for construction increased 13 per cent in quantity, and monumental stone 5 per cent. Flagstone increased 21 per cent, whereas stone for paving blocks and curbing decreased 10 and 16 per cent, respectively. Operating costs and labor conditions were little different from those prevailing in 1927 and 1928, and in general prices for 1929 were reported as the same as or less than those for 1928.

Stone sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone............cubic feet..	30, 795, 530	$42, 769, 904	34, 761, 140	$43, 905, 123
Approximate equivalent in short tons..........	2, 453, 330	....	2, 647, 410	....
Monumental stone............cubic feet..	4, 203, 780	14, 966, 498	4, 410, 140	15, 848, 126
Approximate equivalent in short tons..........	347, 760	....	366, 230	....
Paving blocks............number..	35, 426, 860	3, 113, 526	31, 849, 130	2, 942, 991
Approximate equivalent in short tons..........	349, 290	....	300, 360	....
Curbing............cubic feet..	4, 832, 160	4, 698, 313	4, 054, 700	3, 843, 961
Approximate equivalent in short tons..........	383, 070	....	336, 360	....
Flagging............cubic feet..	932, 900	717, 049	1, 129, 690	666, 987
Approximate equivalent in short tons..........	74, 900	....	87, 750	....
Rubble............short tons..	907, 890	1, 249, 703	907, 810	1, 324, 681
Riprap............do....	3, 993, 190	3, 865, 895	4, 212, 990	5, 030, 743
Crushed stone............do....	91, 265, 360	94, 186, 259	92, 721, 260	94, 387, 878
Furnace flux (limestone and marble)..........do....	23, 123, 870	16, 957, 264	24, 393, 500	18, 034, 910
Refractory stone (ganister, mica schist, and dolomite)............short tons..	1, 348, 160	1, 745, 066	1, 558, 200	1, 807, 324
Agricultural limestone............do....	2, 186, 870	3, 153, 848	2, 654, 580	3, 764, 775
Manufacturing industries (limestone and marble) ....short tons..	5, 639, 750	4, 723, 810	7, 430, 750	6, 361, 201
Other uses............do....	1, 796, 070	4, 673, 562	3, 492, 380	4, 774, 062
Total (quantities approximate, in short tons)..	133, 869, 510	196, 820, 697	141, 109, 580	202, 692, 762

Building stone.—Aggregate sales of building stone of all kinds increased 13 per cent in quantity and 3 per cent in value in 1929, compared with 1928. Sawed stone sold decreased in both quantity and value, whereas the other classes of building stone increased in both quantity and value. The largest increase was in stone sold for rough construction, due chiefly to the large increase in sandstone reported sold for this purpose from quarries in Ohio. As stone of this grade sells at a comparatively low price the increase in total value was proportionately less than the increase in quantity. The production of building stone by States is reported under the different varieties of stone.

Building stone sold or used by producers in the United States, 1928 and 1929, by kinds

Kind	Rough				Finished				Total	
	Constructional		Architectural		Sawed [1]		Cut [1]			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1928										
Granite	4, 286, 560	$714, 324	1, 011, 260	$1, 280, 606	[1] 493, 780	[1] $839, 570	[1] 912, 830	[1] $4, 836, 513	6, 704, 430	$7, 671, 013
Basalt	316, 000	61, 275							316, 000	61, 275
Marble			827, 040	1, 873, 686	881, 630	2, 607, 951	1, 315, 970	7, 627, 690	3, 024, 640	12, 109, 327
Limestone	1, 730, 500	279, 434	5, 255, 690	3, 268, 140	6, 047, 650	4, 644, 923	4, 607, 530	12, 001, 466	17, 641, 370	20, 193, 963
Sandstone	681, 950	149, 310	759, 720	472, 930	943, 030	1, 015, 750	237, 990	1, 005, 287	2, 622, 690	2, 643, 277
Miscellaneous	486, 400	91, 049							486, 400	91, 049
	7, 501, 410	1, 295, 392	7, 853, 710	6, 895, 362	8, 366, 090	9, 108, 194	7, 074, 320	25, 470, 956	30, 795, 530	42, 769, 904
1929										
Granite	3, 659, 800	616, 713	1, 295, 990	1, 207, 346	[1] 326, 250	[1] 692, 368	[1] 920, 230	[1] 5, 588, 937	6, 202, 270	8, 105, 364
Basalt	487, 800	65, 462							487, 800	65, 462
Marble			769, 120	1, 747, 190	632, 840	1, 864, 474	1, 376, 840	8, 514, 052	2, 778, 800	12, 125, 716
Limestone	2, 242, 050	280, 564	6, 192, 550	3, 779, 639	4, 632, 040	4, 168, 063	4, 798, 060	12, 420, 991	17, 864, 700	20, 649, 257
Sandstone	3, 489, 220	320, 630	423, 470	332, 038	662, 040	842, 225	295, 940	1, 171, 421	4, 870, 670	2, 666, 314
Miscellaneous	2, 556, 900	293, 010							2, 556, 900	293, 010
	12, 435, 770	1, 576, 379	8, 681, 130	7, 066, 213	6, 253, 170	7, 567, 130	7, 391, 070	27, 695, 401	34, 761, 140	43, 905, 123

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[1] For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.

Rubble and riprap.—In addition to the production of building stone as given in the preceding table, a large quantity of stone is reported as used for construction in the form of rubble stone or irregularly shaped stone of all sizes. This stone is used for rough walls, foundations, and other rough construction work where the stone is embedded in mortar or plaster. It is not included, however, with the figures for regular building stone. The quantity of this class of stone reported for 1929 was about the same as that for 1928, but the total value showed an increase. Some quarrymen use the term "rubble" to include stone sold for riprap; the latter is generally a larger-sized stone and, when used for walls and foundations, usually as a protection against the encroachment of water, is in loose piles without cementing material. The quantity of riprap produced in 1929 increased 6 per cent, as compared with 1928. The increase was largely in the limestone and sandstone used and was partly accounted for by the increased use of stone in repair work occasioned by the floods of 1928 on the Missouri and Mississippi Rivers.

Monumental stone.—Stone for monumental and memorial work in 1929 increased 5 per cent in quantity and 6 per cent in value over 1928. The stone used for this class of work is chiefly granite (76 per cent of the total) and marble (24 per cent of the total); a small amount of limestone, not segregated in the figures, is also used for this work. The output of both granite and marble for this purpose increased. Quarriers of both varieties of monumental stone sell their product in rough blocks and as finished stone. The quantity of rough granite and marble sold increased in 1929 whereas the value decreased; both quantity and value of dressed stone sold increased. Vermont and Georgia produce more marble for memorials than any other States, and Vermont, Minnesota, Wisconsin, and North Carolina more granite.

Paving blocks, curbstone, flagstone, and crushed stone.—Stone for flagging showed considerable increase in quantity but decrease in value of sales in 1929. Crushed stone comprised 66 per cent of the total stone output in 1929; the total output of crushed stone in 1929 (92,721,260 short tons, valued at $94,387,878) increased 1.6 per cent in quantity but less than 1 per cent in value compared with 1928. Crushed stone for concrete and road metal (76,174,770 tons, valued at $80,685,493) increased 2 per cent in quantity but decreased slightly in value, and crushed stone reported for railroad ballast (16,546,490 tons, valued at $13,702,385) decreased 2 per cent in quantity but increased 4 per cent in value. Stone for curbing decreased 16 per cent in quantity and 18 per cent in value; the decrease was general for all varieties of stone sold for this purpose. The year 1929 marked the sixth consecutive year of decreased output of paving blocks, the total number sold (31,849,130 blocks, valued at $2,942,991) being 10 per cent less than in 1928; the decrease in 1929 was in granite paving blocks as the number of sandstone blocks increased.

Fluxing stone.—Stone (limestone and marble) used by blast furnaces, open-hearth steelworks, smelters, and other metallurgical plants for fluxing (24,393,500 short tons, valued at $18,034,910) increased 5 per cent in quantity and 6 per cent in value over 1928.

Refractory stone.—Stone (dolomite, quartzite, and mica schist) reported for refractory use amounted to 1,558,200 short tons, valued at $1,807,324, in 1929, an increase of 16 per cent in quantity and 4 per cent in value. More than 64 per cent of the refractory stone is quartzite (ganister), used chiefly for the manufacture of silica brick but to some extent for furnace and kiln linings, manufacture of ferrosilicon, etc.; the output of this stone in 1929 (1,004,400 tons, valued at $1,200,634) increased 27 per cent in quantity. Mica schist used for furnace and kiln linings amounted to 37,400 tons, valued at $145,246, in 1929, an increase of 8 per cent in quantity. High-magnesium limestone (dolomite) reported as raw stone for refractory use amounted to 516,400 tons, valued at $461,444, in 1929, a decrease of 1 per cent in quantity. Exact figures for the raw dolomite used for refractories are difficult to obtain because sales to furnaces and smelters tend to cause it to be reported as fluxing stone. Dolomite is used either as raw stone ("rice dolomite") or it is dead-burned. Operators who both quarry and dead-burn or sinter dolomite reported 488,032 short tons of the sintered material, valued at $4,261,942, an increase of 9 per cent in quantity over 1928.

Agricultural limestone.—Sales of agricultural limestone in 1929 amounted to 2,654,580 short tons, valued at $3,764,775, an increase of 21 per cent in quantity and 19 per cent in value. Burned lime used for agriculture (338,329 short tons, valued at $2,387,901, as given in the report of this series on lime) increased 1 per cent in quantity.

Manufacturing industries and "other uses."—The total quantity of stone for manufacturing industries and "other uses" showed a large increase in 1929 over 1928, due not only to increased use of stone for some of the chief chemicals that use limestone in their manufacturing processes but also to local conditions causing a demand for stone for "other uses."

PRODUCTION BY STATES

Pennsylvania ranks as the largest producer of stone, followed by Ohio, Michigan, New York, California, and Illinois. Indiana, however, ranks first in value of stone produced, followed by Pennsylvania, New York, and Ohio. Pennsylvania produces more than three times as much stone as Indiana. Pennsylvania, New York, and Ohio produce chiefly crushed stone, and Indiana produces high-grade building stone and crushed stone. The following table shows the relative importance of the different States in quantity and value of stone produced.

Stone sold or used by producers in the United States, 1928 and 1929, by States

State	1928			1929		
	Number of active plants	Short tons (approximate)	Value	Number of active plants	Short tons (approximate)	Value
Alabama	18	1,261,190	$2,197,831	21	1,262,120	$2,249,601
Alaska	1	(1)	(1)	1	(1)	(1)
Arizona	12	408,210	221,154	17	616,730	582,406
Arkansas	10	381,690	441,596	13	551,730	761,064
California	168	7,838,420	7,516,482	192	11,818,300	10,861,539
Colorado	43	[2] 956,380	[2] 933,241	38	[2] 834,260	[2] 903,846
Connecticut	40	2,852,980	3,743,572	36	[2] 2,621,260	[2] 3,496,520
Delaware	2	(1)	(1)	2	(1)	(1)
District of Columbia	2	(1)	(1)	2	(1)	(1)
Florida	37	3,381,470	2,654,370	35	2,267,140	1,688,224
Georgia	40	[2] 1,028,060	[2] 5,854,226	42	977,910	6,417,329
Hawaii	9	[2] 538,740	[2] 931,061	10	461,340	848,735
Idaho	43	851,540	1,157,236	21	313,660	335,957

[1] Included under "Undistributed."

[2] To avoid disclosing confidential information, certain State totals are slightly incomplete, the figures not included being combined under "Undistributed."

Stone sold or used by producers in the United States, 1928 and 1929, by States—Continued

State	1928			1929		
	Number of active plants	Short tons (approximate)	Value	Number of active plants	Short tons (approximate)	Value
Illinois	73	9,728,920	$8,098,390	80	8,407,730	$7,003,208
Indiana	76	[2] 5,102,280	[2] 22,720,411	85	5,129,220	22,191,883
Iowa	35	1,666,270	1,742,252	44	1,624,400	1,549,743
Kansas	45	[2] 1,203,270	[2] 1,212,598	49	1,419,890	1,461,146
Kentucky	87	2,710,360	2,892,426	78	2,447,540	2,587,592
Louisiana	1	(1)	(1)	1	(1)	(1)
Maine	54	413,960	2,579,523	46	354,500	2,902,603
Maryland	40	[2] 926,850	[2] 1,692,111	46	1,163,630	1,915,014
Massachusetts	93	[2] 2,879,990	[2] 7,732,247	94	[2] 3,127,500	[2] 8,056,302
Michigan	24	12,472,600	7,588,480	25	[2] 13,586,230	[2] 8,454,702
Minnesota	61	[2] 474,450	[2] 3,699,498	54	517,720	4,460,383
Mississippi	3	(1)	(1)	3	(1)	(1)
Missouri	118	3,445,690	6,137,631	124	4,397,800	7,085,323
Montana	26	235,180	234,334	22	194,320	242,412
Nebraska	5	234,590	399,971	5	178,200	335,789
Nevada	17	[2] 824,910	[2] 601,664	3	33,400	51,805
New Hampshire	26	[2] 166,040	[2] 1,423,426	24	[2] 135,640	[2] 1,153,465
New Jersey	44	3,186,940	4,578,642	41	2,740,410	4,219,553
New Mexico	1	(1)	(1)	5	[2] 20,930	[2] 21,193
New York	132	[2] 10,743,470	[2] 15,785,511	165	[2] 11,693,640	[2] 15,895,914
North Carolina	34	2,126,560	4,690,949	37	1,607,670	3,880,113
Ohio	128	13,717,410	14,195,607	173	14,771,030	14,957,234
Oklahoma	27	[2] 1,986,890	[2] 1,743,588	31	2,096,080	1,728,938
Oregon	103	1,875,250	2,117,322	110	[2] 1,951,890	[2] 1,905,747
Pennsylvania	401	16,546,850	18,871,736	377	18,169,270	19,956,410
Porto Rico	14	79,730	136,341	11	55,960	90,675
Rhode Island	17	149,130	707,257	16	141,290	590,627
South Carolina	15	1,278,190	2,203,863	15	1,067,060	1,702,575
South Dakota	25	172,360	451,869	25	250,440	635,890
Tennessee	47	[2] 2,335,530	[2] 7,288,666	48	[2] 2,419,070	[2] 8,043,006
Texas	40	3,130,050	2,522,495	54	[2] 3,647,150	[2] 2,948,865
Utah	20	881,730	818,415	17	[2] 206,590	[2] 249,592
Vermont	43	[2] 448,060	[2] 9,438,796	41	[2] 367,240	[2] 9,435,680
Virginia	94	[2] 3,289,350	[2] 3,358,104	92	[2] 3,605,210	[2] 3,662,569
Washington	101	1,037,160	1,325,768	112	1,673,390	1,960,460
West Virginia	25	[2] 3,143,780	[2] 2,908,657	30	3,375,590	3,056,174
Wisconsin	140	3,313,740	5,516,017	150	[2] 4,004,200	[2] 6,166,708
Wyoming	15	[2] 280,180	[2] 454,136	8	322,260	473,678
Undistributed		2,163,110	3,301,227		2,481,040	3,514,570
	2,675	133,869,510	196,820,697	2,771	141,109,580	202,692,762

[1] Included under "Undistributed."
[2] To avoid disclosing confidential information, certain State totals are slightly incomplete, the figures not included being combined under "Undistributed."

EXPORTS AND IMPORTS[1]

Value of stone exported from the United States, 1920–1929

Year	Marble in blocks, rough or dressed, and other building or monumental stone[2]	Other manufactures of stone[2]	Total	Year	Marble in blocks, rough or dressed, and other building or monumental stone[2]	Other manufactures of stone[2]	Total
1920	$774,442	$2,158,764	$2,933,206	1925	$507,391	$725,677	$1,233,068
1921	576,905	1,697,570	2,274,475	1926	687,115	896,130	1,583,245
1922	681,658	903,102	1,584,760	1927[3]	[4] 1,088,949	[5] 1,005,636	2,094,585
1923	625,442	783,195	1,408,637	1928[3]	[4] 727,432	[5] 1,245,792	1,973,224
1924	499,602	448,731	948,333	1929[3]	[4] 1,077,286	[5] 1,487,993	2,565,279

[1] Figures on exports and imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.
[2] Exports classification beginning 1922; prior to 1922 classification read "Stone including marble—unmanufactured and all other."
[3] Figures not separately recorded for 1927, 1928, and 1929 for stone and for cement building blocks and for stone and for cement manufactures.
[4] Composed in 1927 of "marble in blocks, rough or dressed," $237,233, and "other building or monumental stone (including cement building blocks)," $851,716; in 1928 of $254,266 and $473,166, and in 1929 of $394,654 and $682,632, respectively.
[5] Classification reads "Other manufactures of stone (including other cement manufactures)."

Stone exported from the United States in 1929, by countries

Country	Marble in blocks, rough or dressed		Other building or monumental stone (including cement building blocks)[1]		Value of other manufactures of stone (including paving blocks and curbing and cement manufactures)[1]	Total value
	Cubic feet	Value	Cubic feet	Value		
North America:						
Canada	84, 226	$332, 110	803, 907	$667, 132	$885, 631	$1, 884, 873
Central America—						
British Honduras	361	777	1	14	925	1, 716
Costa Rica			250	209	838	1, 047
Guatemala					935	935
Honduras	44	222			1, 022	1, 244
Nicaragua	11	132			483	615
Panama	908	4, 658	35	100	13, 440	18, 198
Salvador					121	121
Mexico	5, 973	17, 320	13, 127	4, 187	55, 454	76, 961
Newfoundland and Labrador	1, 808	9, 873			3, 864	13, 737
West Indies—						
British—						
Bermuda	1	11			330	341
Jamaica					588	588
Trinidad and Tobago	10	81			51	132
Other	6	109	154	562	2, 362	3, 033
Cuba			611	2, 250	233, 136	235, 386
Dominican Republic	19	93	20	254	3, 803	4, 150
Haiti					631	631
Netherland					8, 864	8, 864
Virgin Islands of the United States					603	603
Other					106	106
South America:						
Argentina					11, 825	11, 825
Brazil					3, 984	3, 984
Chile	49	346			3, 368	3, 714
Colombia	1, 059	4, 299			10, 161	14, 460
Ecuador					942	942
Peru	1	14			1, 894	1, 908
Venezuela	56	1, 187			3, 146	4, 333
Other					781	781
Europe:						
France	543	6, 549			63, 485	70, 034
Germany					23, 961	23, 961
Netherlands					8, 926	8, 926
United Kingdom	3, 275	16, 432	310	210	10, 530	27, 172
Other					7, 751	7, 751
Asia:						
China					2, 147	2, 147
India (British)					45, 968	45, 968
Japan	126	431	2, 256	3, 267	8, 861	12, 559
Philippine Islands					2, 510	2, 510
Other			70	215	20, 577	20, 792
Africa:						
Union of South Africa			224	2, 210	6, 041	8, 251
Other			8	30	873	903
Oceania:						
Australia			4, 281	1, 992	29, 892	31, 884
New Zealand					6, 756	6, 756
Other	2	10			427	437
	98, 478	394, 654	825, 254	682, 632	1, 487, 993	2, 565, 279

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[1] Figures not separately recorded for 1929 for stone and for cement building blocks and for stone and for cement manufactures.

Value of stone imported for consumption in the United States, 1920–1929

1920	$1, 795, 575	1925	$2, 909, 887
1921	1, 253, 959	1926	3, 523, 578
1922	1, 895, 912	1927	4, 536, 407
1923	2, 641, 337	1928	3, 491, 353
1924	2, 437, 654	1929	3, 589, 259

Stone imported for consumption in the United States, 1928 and 1929, by kinds

Kind	1928		1929	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
In blocks, rough, etc. .... cubic feet	586, 061	$1, 673, 344	667, 900	$1, 591, 070
Sawed .... do	8	19	10, 859	24, 799
Slabs or paving tiles .... superficial feet	845, 464	310, 785	649, 899	253, 267
All other manufactures	----------	483, 071	----------	566, 010
Mosaic cubes of marble or onyx:				
Loose	----------	6, 015	----------	1, 875
Attached to paper	----------	111	----------	33
	----------	2, 473, 345	----------	2, 437, 054
Granite:				
Dressed	----------	244, 043	----------	292, 644
Rough .... cubic feet	178, 427	272, 428	216, 022	378, 943
	----------	516, 471	----------	671, 587
Stone (other):				
Dressed	----------	40, 007	----------	62, 674
Rough (monumental or building stone) .... cubic feet	244, 346	237, 595	240, 399	184, 620
Rough (other)	----------	223, 935	----------	233, 324
	----------	501, 537	----------	480, 618
Grand total	----------	3, 491, 353	----------	3, 589, 259

Marble, breccia, and onyx (rough and manufactures) imported into the United States, 1928 and 1929, by countries

[General imports]

Country	1928				1929			
	Rough marble, breccia, and onyx		Manufactures (value)	Total value	Rough marble, breccia, and onyx		Manufactures (value)	Total value
	Cubic feet	Value			Cubic feet	Value		
Canada	--------	--------	$769	$769	1, 877	$7, 511	$14, 517	$22, 028
Cuba	--------	--------	923	923	--------	--------	2, 714	2, 714
Dominican Republic	12	$10	--------	10	--------	--------	--------	--------
Guatemala	1, 062	2, 507	--------	2, 507	--------	--------	--------	--------
Mexico	24, 631	97, 855	114	97, 969	18, 687	76, 889	1, 277	78, 166
Total North America	25, 705	100, 372	1, 806	102, 178	20, 564	84, 400	18, 508	102, 908
Belgium	61, 633	108, 273	61, 419	169, 692	63, 008	109, 041	100, 779	209, 820
France	70, 090	152, 444	131, 109	283, 553	136, 270	246, 009	174, 396	420, 405
Germany	13, 152	43, 178	88, 442	131, 620	10, 854	32, 431	97, 460	129, 891
Greece	15, 470	73, 776	64	73, 840	8, 959	47, 081	97	47, 178
Italy	384, 494	1, 121, 822	471, 274	1, 593, 096	447, 661	1, 051, 489	367, 030	1, 418, 519
Netherlands	2, 018	2, 812	430	3, 242	--------	--------	77	77
Spain	10, 322	26, 392	415	26, 807	20, 671	45, 478	1, 594	47, 072
United Kingdom	100	344	13, 665	14, 009	794	3, 255	22, 466	25, 721
Other Europe [1]	2, 364	4, 719	21, 187	25, 906	9, 649	16, 903	19, 958	36, 861
Total Europe	559, 643	1, 533, 760	788, 005	2, 321, 765	697, 866	1, 551, 687	783, 857	2, 335, 544
China	--------	--------	10, 384	10, 384	--------	--------	9, 343	9, 343
Japan	--------	--------	2, 856	2, 856	--------	--------	2, 929	2, 929
Other countries [2]	5, 163	56, 627	1, 539	58, 166	8, 610	97, 913	12, 691	110, 604
	5, 163	56, 627	14, 779	71, 406	8, 610	97, 913	24, 963	122, 876
Grand total	590, 511	1, 690, 759	804, 590	2, 495, 349	727, 040	1, 734, 000	827, 328	2, 561, 328

[1] 1928: Austria, Denmark, Finland, Hungary, Irish Free State, Portugal, Rumania, Sweden, and Switzerland; 1929: Austria, Czechoslovakia, Denmark, Finland, Gibraltar, Hungary, Irish Free State, Malta and Gozo, Cyprus, Norway, Poland and Danzig, Portugal, Rumania, Soviet Russia, Switzerland, and Yugoslavia and Albania.

[2] 1928: Algeria and Tunisia, Argentina, Australia, Ecuador, Egypt, Hong Kong, India (British), Palestine, Syria, and Uruguay; 1929: Algeria and Tunisia, Argentina, Brazil, Ceylon, Egypt, Hong Kong, India (British), Palestine- Syria, Turkey in Asia, and Union of South Africa.

Value of building or monumental stone (exclusive of marble, breccia, and onyx) and other classes of stone imported into the United States, 1928 and 1929, by countries

[General imports]

Country	1928			1929		
	Building or monumental stone	Other stone	Total	Building or monumental stone	Other stone	Total
North America:						
Canada	$34, 277	$211, 857	$246, 134	$35, 614	$205, 874	$241, 488
Mexico	57		57	23	4, 460	4, 483
Total North America	34, 334	211, 857	246, 191	35, 637	210, 334	245, 971
Europe:						
Austria	39		39	58		58
Belgium	5, 634		5, 634	3, 036		3, 036
Czechoslovakia	37, 919		37, 919	37, 347		37, 347
Denmark	2, 021	625	2, 646		553	553
Finland	82, 840		82, 840	151, 574		151, 574
France	81, 382	128	81, 510	57, 333	172	57, 505
Germany	106, 474	9, 786	116, 260	121, 511	6, 328	127, 839
Italy	211, 252		211, 252	228, 257		228, 257
Netherlands	1, 493	114	1, 607	16, 843	600	17, 443
Norway	15, 044		15, 044	59, 140	186	59, 326
Portugal	9, 076		9, 076	22, 638		22, 638
Spain	849		849	3, 083		3, 083
Sweden	182, 611		182, 611	224, 687		224, 687
United Kingdom	29, 550	10, 955	40, 505	53, 523	6, 243	59, 766
Other Europe	30		30	1, 063	500	1, 563
Total Europe	766, 214	21, 608	787, 822	980, 093	14, 582	994, 675
Other countries [1]	3, 045	76	3, 121	9, 944	18	9, 962
Grand total	803, 593	233, 541	1, 037, 134	1, 025, 674	224, 934	1, 250, 608

[1] 1928: Canary Islands, Ceylon, China, Cuba, Hong Kong, and Japan; 1929: Brazil, China, Cuba, Hong Kong, Japan, Palestine, and Union of South Africa.

PRODUCTION BY KINDS AND STATES

GRANITE

The output of granite in 1929 (10,826,730 short tons, valued at $34,225,110) increased 13 per cent in quantity but less than 1 per cent in value compared with 1928; the increase was due entirely to the large amount of stone quarried in California for use as fill in dam construction, the figures for which are included under "Other uses." Granite for memorial use and for rubble also increased in output but not enough to cover decreases in stone for construction, street and road work, and riprap. Granite for monumental work increased 5 per cent in quantity and 7 per cent in value; the increase was largely in sales of finished stone. Granite sold as rubble increased 62 per cent in quantity and 63 per cent in value. Granite paving blocks decreased 14 per cent in number and 10 per cent in value. Granite for curbing decreased 18 per cent in both quantity and value. Crushed stone, which represented more than one-half of the total quantity of granite in 1929, decreased 15 per cent in total quantity and 14 per cent in total value; crushed granite for concrete and road metal decreased 16 per cent in quantity and that for railroad ballast 11 per cent. Granite for construction decreased 7 per cent in quantity but increased 6 per cent in value. As shown in the table on page 231, the decrease in granite for construction was in both the rough and the dressed stone sold for heavy construction work. Architectural building stone showed increase in quantity for both the rough and the dressed material sold by the quarrymen.

Granite sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone (rough and dressed) .... cubic feet..	6,704,430	$7,671,013	6,202,270	$8,105,364
Approximate equivalent in short tons	556,670		511,000	
Monumental stone .... cubic feet..	3,172,730	11,217,229	3,344,380	11,962,645
Approximate equivalent in short tons	260,210		275,720	
Paving .... number of blocks..	32,949,300	2,934,604	28,174,330	2,651,383
Approximate equivalent in short tons	321,300		259,470	
Curbing .... linear feet..	3,548,220	2,607,152	2,905,070	2,126,421
Approximate equivalent in short tons	190,070		162,740	
Rubble .... short tons..	310,720	321,442	502,100	523,583
Riprap .... do....	806,990	660,955	651,890	734,131
Crushed stone .... do....	6,939,310	8,375,033	5,923,650	7,225,647
Other uses .... do....	171,230	207,099	2,540,160	895,936
Total (quantities approximate, in short tons)	9,556,500	33,994,527	10,826,730	34,225,110

Chiefly because of the large amount of stone quarried for a rock fill on a dam, California was the largest producer of granite in 1929; it was followed in order by North Carolina, South Carolina, Virginia, and Massachusetts. The leading State in value of granite output, however, was Massachusetts; it was followed by Vermont, North Carolina, and Minnesota. The granite from South Carolina and Virginia is used principally for crushed stone; that from Vermont and Minnesota for monumental stone and architectural building stone; and that from California, Massachusetts, and North Carolina for many kinds of granite products.

Granite sold or used by producers in the United States, 1928 and 1929, by States

[Quantities approximate]

State	1928		1929	
	Short tons	Value	Short tons	Value
Arizona	51,340	$38,832	1,430	$3,393
Arkansas	(1)	(1)		
California	1,981,500	2,202,585	3,702,550	3,007,501
Colorado	44,750	205,785	36,720	276,618
Connecticut	48,260	429,152	47,570	550,405
Delaware	(1)	(1)	(1)	(1)
District of Columbia	(1)	(1)	(1)	(1)
Georgia	415,830	2,275,232	493,670	2,151,354
Idaho	(1)	(1)	(1)	(1)
Maine	280,690	2,358,375	228,710	2,688,589
Maryland	280,440	699,574	430,130	746,126
Massachusetts	716,780	4,596,457	751,180	4,840,852
Minnesota	53,860	2,649,004	66,580	3,249,752
Missouri	14,110	69,707	9,760	54,642
Montana	14,090	45,291	9,290	40,145
New Hampshire	166,040	1,423,426	135,640	1,153,465
New Jersey	(1)	(1)	(1)	(1)
New York	122,690	1,056,630	221,270	616,573
North Carolina	1,868,860	4,342,718	1,458,000	3,569,961
Oklahoma	37,790	156,354	17,250	174,650
Oregon	(1)	(1)	(1)	(1)
Pennsylvania	328,330	677,372	285,540	598,912
Rhode Island	100,950	607,495	42,350	423,695
South Carolina	1,278,190	2,203,863	1,067,060	1,702,575
South Dakota	12,700	243,148	11,950	300,134
Texas	26,550	195,409	19,430	187,081
Utah			400	13,900
Vermont	264,200	4,351,724	194,940	4,507,716
Virginia	787,620	772,838	923,010	1,003,034
Washington	80,310	86,920	112,760	94,881
Wisconsin	391,130	1,971,422	355,060	1,918,407
Undistributed	189,490	335,214	204,480	350,749
	9,556,500	33,994,527	10,826,730	34,225,110

[1] Included under "Undistributed."

The following table shows the uses of the stone produced and sold by the quarrymen in the various States.

Granite sold or used by producers in the United States in 1929, by States and uses

State	Number of active plants	Building						Monumental				Paving blocks	
		Rough				Dressed		Rough		Dressed			
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Number	Value
Arizona	3							(1)	(1)				
California	35			(2)	(2)	[2] 110,760	[2] $648,264	68,600	$88,029	67,260	$504,614		
Colorado	8			(1)	(1)			25,300	80,173	16,340	157,361		
Connecticut	12	4,880	$8,459	9,750	$10,997	50,790	302,802	39,160	75,394	7,330	43,029	(1)	(1)
Delaware	2	(1)	(1)										
District of Columbia	2	(1)	(1)										
Georgia	29	(1)	(1)	8,000	5,420	47,620	304,205	246,250	358,165	65,360	233,482	3,492,250	$267,436
Idaho	1			(1)	(1)			(1)	(1)	(1)	(1)		
Maine	36			266,310	208,492	171,140	473,603	189,350	186,759	13,320	82,183	13,863,470	1,429,876
Maryland	11	113,430	229,080			(1)	(1)	(1)	(1)				
Massachusetts	47	26,280	65,477	768,770	747,870	302,390	1,531,370	161,260	312,497	46,720	388,317	3,242,640	320,614
Minnesota	28			9,990	21,746	322,330	1,525,784	96,870	231,444	185,620	1,447,691	(1)	(1)
Missouri	3			(1)	(1)			(1)	(1)			(1)	(1)
Montana	11					(1)	(1)	3,690	7,448	2,500	24,507		
New Hampshire	23	470	3,466	51,470	44,358	93,190	519,565	89,370	144,815	19,390	78,296	1,295,090	94,961
New Jersey	2												
New York	29	18,480	23,290	14,410	11,494	31,010	242,227	10,150	14,941	1,670	9,534		
North Carolina	28	3,010	5,262	(1)	(1)	(1)	(1)	(2)	(2)	[2] 106,160	[2] 884,503	2,511,650	187,543
Oklahoma	9					(1)	(1)	4,200	8,250	17,790	151,653		
Oregon	1									(1)	(1)		
Pennsylvania	30	98,090	224,420	63,490	38,788	36,530	6,075	[3] 25,200	[3] 82,561	(3)	(3)	91,130	8,730
Rhode Island	10	(1)	(1)			(1)	(1)	(2)	(2)	[2] 77,400	[2] 348,173		
South Carolina	15	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
South Dakota	7	(1)	(1)					(2)	(2)	[2] 40,110	[2] 280,245		
Texas	8			(2)	(2)	[2] 8,880	[2] 29,708	52,640	104,658	2,420	31,441		
Utah	2							2,000	8,000	980	5,900		
Vermont	24	(1)	(1)	(1)	(1)	(1)	(1)	1,305,110	3,755,177	45,840	339,070	(1)	(1)
Virginia	10	6,920	13,260					(1)	(1)				
Washington	15					(1)	(1)	(2)	(2)	[2] 4,220	[2] 14,410		
Wisconsin	23			(2)	(2)	[2] 17,650	[2] 187,207	32,330	46,937	103,690	1,087,183	2,659,400	250,683
Undistributed		29,140	43,999	87,250	85,706	70,740	542,970	167,160	338,572	1,620	7,233	1,018,700	91,540
	464	300,700	616,713	1,295,990	1,207,346	1,246,480	6,281,305	2,597,890	6,047,740	746,490	5,914,905	28,174,330	2,651,383

[1] Included under "Undistributed."

[2] Rough stone included under dressed stone.

[3] Dressed stone included under rough stone.

Granite sold or used by producers in the United States in 1929, by States and uses—Continued

State	Curbing		Rubble		Riprap		Crushed stone				Other uses		Total	
							Concrete and road metal		Railroad ballast					
	Linear feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Arizona					(1)	(1)	(1)	(1)					1,430	$3,393
California	(1)	(1)	319,450	$319,407	116,660	$59,790	590,800	$476,751	225,000	$157,500	(1)	(1)	3,702,550	3,007,501
Colorado							33,180	38,684			(1)	(1)	36,720	276,618
Connecticut	37,220	$40,978	(1)	(1)	7,430	6,280	4,410	5,603			2,400	$2,820	47,570	550,405
Delaware					(1)	(1)	(1)	(1)					(1)	(1)
District of Columbia			(1)	(1)									(1)	(1)
Georgia	900,690	573,230	(1)	(1)	25,550	20,235	261,700	291,592	57,440	52,453	(1)	(1)	493,670	2,151,354
Idaho													(1)	(1)
Maine	300,050	249,353	(1)	(1)	(1)	(1)	23,060	49,875					228,710	2,688,589
Maryland	(1)	(1)	(1)	(1)			229,350	350,573	81,700	115,892			430,130	746,126
Massachusetts	659,690	601,601	38,360	37,337	17,110	9,379	480,710	813,730			5,260	12,660	751,180	4,840,852
Minnesota			(1)	(1)	11,750	4,059	3,000	3,800					66,580	3,249,752
Missouri					5,000	5,750	(1)	(1)					9,760	54,642
Montana	(1)	(1)	(1)	(1)	(1)	(1)							9,290	40,145
New Hampshire	303,000	177,651	(1)	(1)	11,760	9,892	54,520	73,975			(1)	(1)	135,640	1,153,465
New Jersey							(1)	(1)					(1)	(1)
New York					(1)	(1)	84,570	116,864	48,750	40,688	(1)	(1)	221,270	616,573
North Carolina	634,870	462,733	29,760	67,621	34,160	28,045	1,192,250	1,534,602	114,150	114,448	10,600	35,375	1,458,000	3,569,961
Oklahoma			(1)	(1)	(1)	(1)	(1)	(1)					17,250	174,650
Oregon													(1)	(1)
Pennsylvania	1,390	1,530	14,180	21,411	1,260	1,209	74,560	111,426	85,000	102,000	350	762	285,540	598,912
Rhode Island	(1)	(1)			(1)	(1)	32,970	58,008					42,350	423,695
South Carolina	(1)	(1)	6,200	7,133	19,310	26,009	948,150	1,262,740	77,720	76,096			1,067,060	1,702,575
South Dakota			(1)	(1)	(1)	(1)	3,750	8,259			4,800	11,520	11,950	300,134
Texas					(1)	(1)					(1)	(1)	19,430	187,081
Utah													400	13,900
Vermont	(1)	(1)	32,650	19,639			43,870	56,945					194,940	4,507,716
Virginia	2,580	1,600			(1)	(1)	158,250	153,195	668,440	630,592			923,010	1,003,034
Washington			(1)	(1)	36,550	19,350	48,000	47,200			25,840	13,250	112,760	94,881
Wisconsin					135,440	112,268	141,340	210,558			42,180	23,571	355,060	1,918,407
Undistributed	65,580	17,745	61,500	51,035	229,910	431,865	157,010	271,598			2,448,730	795,978	204,480	350,749
	2,905,070	2,126,421	502,100	523,583	651,890	734,131	4,565,450	5,935,978	1,358,200	1,289,669	[4]2,540,160	[4]895,936	10,826,730	34,225,110

[1] Included under "Undistributed."

[4] Includes 4,580 tons of Durax blocks, valued at $34,793, made in Massachusetts, New Hampshire, and North Carolina.

The following table gives statistics covering sales of monumental granite by the quarrymen at Quincy, Mass., during the past 10 years. The quarry operators furnishing this stone in 1929 were the Granite Railway Co., Gray Rock Granite Co. (Inc.), C. H. Hardwick & Co., The Quincy Quarries Co., Rock Quarry Co., and J. S. Swingle (Inc.), all of Quincy; these quarries also furnished about 15,000 tons of stone, valued at $18,300, for construction work. Crushed-stone plants also are operated in the vicinity of Quincy.

Monumental granite sold by the quarrymen at Quincy, Mass., 1920–1929

Year	Number of active plants	Short tons (approximate)	Value	Year	Number of active plants	Short tons (approximate)	Value
1920	8	27, 000	$674, 233	1925	7	26, 500	$509, 329
1921	6	14, 000	311, 178	1926	7	23, 000	438, 963
1922	6	16, 000	341, 601	1927	5	21, 130	375, 613
1923	6	27, 150	596, 709	1928	6	12, 400	369, 184
1924	6	26, 630	527, 915	1929	6	10, 840	288, 492

The following table shows the quantity and value of monumental granite sold by the quarrymen in the Barre district of Vermont during the past 10 years. The quarry operators in this district in 1929 were the Barre Granite Quarrying Co., Jones Bros. (Inc.), Littlejohn & Milne Quarry Co., James K. Pirie Estate, Rock of Ages Corporation, E. L. Smith & Co., Standard Granite Co. (Inc.), Wells-Lamson Quarry Co., and Wetmore & Morse Granite Co., all of Barre. Granite from this district is used also for construction and for the manufacture of paving blocks.

Monumental granite sold by the quarrymen in the Barre district, Vermont, 1920–1929

Year	Cubic feet	Value	Year	Cubic feet	Value
1920	1, 147, 800	$3, 957, 881	1925	981, 560	$3, 192, 282
1921	686, 947	2, 417, 024	1926	1, 062, 160	3, 311, 066
1922	453, 000	1, 395, 911	1927	1, 115, 400	3, 426, 732
1923	1, 208, 010	3, 300, 805	1928	1, 225, 800	3, 395, 628
1924	1, 025, 930	3, 366, 497	1929	1, 140, 540	3, 485, 191

Through the kindness of the Granite Manufacturers' Association, Barre, the following figures covering the entire granite industry of the Barre district are given to supplement the figures of sales reported to the Bureau of Mines by the quarrymen.

Estimated output of monumental granite in Barre district, Vermont, 1926–1929

	1926	1927	1928	1929
Total quarry output, rough stock ____ cubic feet	1, 169, 322	1, 179, 822	1, 549, 443	1, 268, 178
Shipped out of Barre district in rough ____ do	233, 884	235, 964	309, 889	253, 636
Manufactured in Barre district ____ do	935, 438	943, 858	1, 239, 554	1, 014. 542
Light stock consumed in district ____ do	584, 649	589, 910	774, 720	634, 091
Dark stock consumed in district ____ do	350, 789	353, 948	464, 834	380, 451
Number of cutters in district	1, 100	1, 200	1, 600	1, 500
Average daily wage	$8. 00	$9. 00	$9. 00	$9. 00
Average number of days worked	272	227	256	256
Total pay roll for year	$2, 393, 600	$2, 451, 600	$3, 686, 400	$3, 456, 000
Estimated overhead	1, 196, 800	1, 225, 800	1, 843, 200	1, 728, 000
Estimated value of light stock	2, 630. 973	2, 654, 600	3, 486, 240	2, 853, 396
Estimated value of dark stock	1, 885, 533	1, 902, 463	2, 498, 484	2, 044, 942
Estimated polishing cost	739, 830	743, 500	980, 334	802, 377
Output from saws	246. 610	325, 000	326, 778	267, 459
Total value of granite	9, 093, 346	9, 302, 963	12, 821, 436	11, 152, 174

The figures of quantity submitted by the association represent the stone carried to Barre from the quarries by truck and railroad. The figures of the Bureau of Mines represent the sales of stone as reported by the quarry operators.

BASALT AND RELATED ROCKS (TRAP ROCK)

Basalt and related rocks (trap rock) are quarried and sold chiefly for crushed stone. The output in 1929 (14,871,780 short tons, valued at $18,946,197) showed a decrease of 3 per cent in quantity and 4 per cent in value; there were increases in the quantities sold for construction and riprap but decreases in those sold for other purposes. Crushed stone, which represented 96 per cent of the total quantity in 1929, decreased 3 per cent in total quantity and 4 per cent in total value; crushed basalt for concrete and road material decreased 5 per cent in quantity, but that for railroad ballast increased 8 per cent. Under "Other" is reported a total of 129,880 short tons of roofing granules, valued at $861,960, made chiefly from altered diabase (greenstone). In the figures for granite, sandstone, and miscellaneous varieties of stone is also an amount of "roofing granules," which increases the total output of roofing granules made from stone to 153,870 tons, valued at $931,781.

Basalt and related rocks (trap rock) sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone .... cubic feet..	316,000	$61,275	487,800	$65,462
Approximate equivalent in short tons	32,360	....	42,250	....
Rubble .... short tons..	64,390	40,390	9,390	4,896
Riprap .... do....	275,160	372,881	338,480	433,476
Crushed stone .... do....	14,796,790	18,375,468	14,329,880	17,565,319
Other (principally roofing granules) .... do....	159,060	843,931	151,780	877,044
Total (quantities approximate, in short tons).....	15,327,760	19,693,945	14,871,780	18,946,197

Basalt and related rocks (trap rock) sold or used by producers in the United States, 1928 and 1929, by States

[Quantities approximate]

State	1928		1929	
	Short tons	Value	Short tons	Value
California	992,440	$890,264	1,073,760	$1,086,480
Connecticut	2,751,890	3,122,644	2,536,660	2,833,224
Hawaii	538,740	931,061	458,670	839,383
Idaho	720,060	949,013	194,670	203,144
Maryland	362,060	571,182	355,440	522,447
Massachusetts	1,648,730	1,926,458	1,911,840	2,207,677
Michigan	91,360	181,331	(1)	(1)
Minnesota	89,390	290,620	149,810	327,542
Montana	(1)	(1)	(1)	(1)
New Jersey	2,925,110	4,025,637	2,457,620	3,650,332
New York	(1)	(1)	(1)	(1)
Oregon	1,530,430	1,670,627	1,446,100	1,312,458
Pennsylvania	1,455,780	2,192,441	1,443,610	2,143,164
Texas	(1)	(1)	(1)	(1)
Virginia	(1)	(1)	6,150	9,558
Washington	860,210	886,930	1,247,910	1,361,557
Wisconsin	(1)	(1)	(1)	(1)
Undistributed	1,361,560	2,055,737	1,589,540	2,449,231
	15,327,760	19,693,945	14,871,780	18,946,197

[1] Included under "Undistributed."

Basalt and related rocks (trap rock) sold or used by producers in the United States in 1929, by uses

State	Number of active plants	Building, rough construction		Rubble and riprap		Crushed stone				Other uses		Total	
						Concrete and road metal		Railroad ballast					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
California	21	(1)	(1)	(1)	(1)	851,990	$777,627	178,980	$178,635	(1)	(1)	1,073,760	$1,086,480
Connecticut	18	23,270	$36,951			2,218,310	2,501,155	295,080	295,118			2,536,660	2,833,224
Hawaii	9			107,240	$221,550	349,980	615,227	1,400	2,557	50	$49	458,670	839,383
Idaho	10			3,100	2,079	173,770	197,500	17,800	3,565			194,670	203,144
Maryland	8	(1)	(1)	9,610	9,762	159,310	255,519	(1)	(1)	(1)	(1)	355,440	522,447
Massachusetts	22	300	375			1,547,560	1,837,660	363,980	369,642			1,911,840	2,207,677
Michigan	5					(1)	(1)			(1)	(1)	(1)	(1)
Minnesota	3			(1)	(1)	121,090	126,882			(1)	(1)	149,810	327,542
Montana	2			(1)	(1)							(1)	(1)
New Jersey	31	(1)	(1)	(1)	(1)	2,235,220	3,386,423	217,610	255,185	1,410	5,818	2,457,620	3,650,332
New York	3					(1)	(1)					(1)	(1)
Oregon	99			102,520	91,731	1,328,150	1,201,187	14,700	19,000	730	540	1,446,100	1,312,458
Pennsylvania	19	12,400	19,930	6,660	7,924	986,820	1,225,420	345,770	417,929	91,960	471,961	1,443,610	2,143,164
Texas	1			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	1	280	628			5,870	8,930					6,150	9,558
Washington	77			40,110	41,006	1,127,600	1,266,433	78,750	53,009	1,450	1,109	1,247,910	1,361,557
Wisconsin	1			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Undistributed		6,000	7,578	78,630	64,320	1,401,350	2,210,766	308,790	359,950	56,180	397,567	1,589,540	2,449,231
	330	42,250	65,462	347,870	438,372	12,507,020	15,610,729	1,822,860	1,954,590	151,780	877,044	14,871,780	18,946,197

[1] Included under "Undistributed."

MARBLE

The total marble sold by producers in 1929 (553,660 short tons, valued at $16,545,312) represented a decrease of 4 per cent in quantity but an increase of 1 per cent in value compared with 1928. The output of dimension stone used for monumental and construction work (3,844,560 cubic feet, valued at $16,011,197) decreased 5 per cent in quantity but increased 1 per cent in value. Marble used for construction (2,778,800 cubic feet, valued at $12,125,716) decreased 8 per cent in quantity but increased slightly in value. Marble used for monumental and memorial work (1,065,760 cubic feet, valued at $3,885,481) increased 3 per cent in quantity and 4 per cent in value. Rough marble sold by tonnage for terrazzo, stucco, mosaic, marble dust, and by-product stone, such as rubble, riprap, flux, and other rough stone, decreased 3 per cent in quantity and 2 per cent in value.

Marble sold by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone:				
Rough—				
Exterior.....cubic feet..	263,770	$503,176	133,500	$313,053
Interior.....do....	563,270	1,370,510	635,620	1,434,137
Finished—				
Exterior.....do....	755,720	2,643,026	790,920	3,536,457
Interior.....do....	1,441,880	7,592,615	1,218,760	6,842,069
Total exterior.....do....	1,019,490	3,146,202	924,420	3,849,510
Total interior.....do....	2,005,150	8,963,125	1,854,380	8,276,206
Total building stone.....do....	[1] 3,024,640	[1] 12,109,327	[1] 2,778,800	[1] 12,125,716
Monumental stone:				
Rough.....do....	164,300	193,948	188,610	187,623
Finished.....do....	866,750	3,555,321	877,150	3,697,858
Total monumental stone.....do....	[1] 1,031,050	[1] 3,749,269	[1] 1,065,760	[1] 3,885,481
Total building and monumental: cubic feet.....	4,055,690	15,858,596	3,844,560	16,011,197
approximate short tons..	342,590	....	324,030	....
Marble for other uses (by-products).....short tons..	236,900	544,390	229,630	534,115
Total marble, approximate short tons.....	579,490	16,402,986	553,660	16,545,312

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[1] Building-stone figures may be somewhat less than given and monumental stone somewhat more, as some of the Tennessee producers were unable to divide their product according to use.

Marble sold by producers in the United States, 1928 and 1929, by States and uses

State	Building and monumental (rough and finished)		Other uses		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1928						
Alabama	112,580	$735,452	52,840	$57,389	62,400	$792,841
California	(1)	(1)	(1)	(1)	2,000	69,375
Georgia	542,200	2,892,635	26,100	36,845	72,170	2,929,480
Massachusetts	32,180	157,414	1,550	2,251	4,260	159,665
Missouri	631,090	1,421,044	1,480	4,016	53,810	1,425,060
New York	57,570	162,922	41,390	204,954	46,370	367,876
Tennessee	1,236,620	4,982,247	66,350	56,170	170,660	5,038,417
Vermont	1,242,300	4,897,321	32,780	38,236	138,310	4,935,557
Other States [2]	[1] 201,150	[1] 609,561	[1] 14,410	[1] 144,529	29,510	684,715
	4,055,690	15,858,596	236,900	544,390	579,490	16,402,986
1929						
Alabama	52,900	381,781	36,400	61,738	40,900	443,519
California	14,260	71,259	1,570	9,575	2,780	80,834
Georgia	676,190	3,739,825	26,300	37,450	82,920	3,777,275
Massachusetts	19,720	97,910	2,510	3,542	4,180	101,452
Missouri	477,010	927,530	15,900	4,941	55,420	932,471
New York	51,220	129,202	44,160	187,760	48,640	316,962
Tennessee	1,312,180	5,678,596	58,950	60,408	169,630	5,739,004
Vermont	1,185,100	4,763,471	29,350	35,242	129,940	4,798,713
Other States [2]	55,980	221,623	14,490	133,459	19,250	355,082
	3,844,560	16,011,197	229,630	534,115	553,660	16,545,312

[1] California included under "Other States."
[2] 1928: Alaska, Arizona, Arkansas, Colorado, Maryland, New Jersey, Pennsylvania, Texas, Utah, and Washington; 1929: Alaska, Arizona, Arkansas, Colorado, Idaho, Maryland, Montana, New Jersey, North Carolina, Utah, Virginia, and Washington.

SERPENTINE

The figures showing sales of serpentine (verde antique) for interior and exterior building, dimension stone, and by-products are included in the figures for marble, but those showing sales of serpentine as crushed stone for road metal, ballast, riprap, and other low-grade material are included in the figures for "miscellaneous" stone. The States represented in the production of serpentine in 1929 are California, Georgia, Maryland, Massachusetts, New Jersey, Vermont, and Washington.

Serpentine (verde antique) sold by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building and ornamental stone .... cubic feet	109,590	$854,707	111,580	$842,058
Rough construction, crushed, etc. .... short tons	53,840	104,764	138,530	310,612
	----------	959,471	----------	1,152,670

PRODUCING LOCALITIES—MARBLE, "ONYX," AND SERPENTINE

The locations of the marble, "onyx," and serpentine deposits in the United States reporting in 1929 and the owners or operators of these deposits, by States, are as follows:

Alabama.—Marble was produced in Alabama in 1929 for commercial purposes by the Alabama Marble Co., at Gantts Quarry, and by the Madras Marble Corporation (succeeded January, 1930, by the Sylacauga Marble Corporation) and the Moretti-Harrah Marble Co., both at Sylacauga. This marble is sold for building and monumental work, with the broken stone for terrazzo, riprap, whiting substitute, furnace flux, and other crushed stone.

Alaska.—The only marble quarries operated in Alaska are those of the Vermont Marble Co. (Proctor, Vt.) at Tokeen and Calder. The stone is shipped in rough blocks from the quarries to finishing plants and is used entirely for interior building.

Arizona.—Deposits of "onyx" marble were operated in 1929 at Cave Creek, near Phoenix, Maricopa County, by the Arizona Onyx Manufacturing Co. The Yavapai Onyx Corporation, which operated at Mayer, Yavapai County, in 1928, was reported idle in 1929, pending reorganization of the company.

Arkansas.—The marble quarries at Batesville, Independence County, are owned by the Batesville Marble Quarries Co. and the Terry Marble Corporation. The latter has recently opened its quarry and expects to ship black marble in 1930. The White River Marble Co. produces at irregular intervals a small amount of stone at Cartney, Baxter County.

California.—The companies producing marble during 1929 for dimension stone were as follows: The Carrara Marble Co. of Amador County (address, 2895 Third Street, San Francisco), Jackson, Amador County; the Inyo Marble Co. (address, 406 South Main Street, Los Angeles), Lone Pine, Inyo County; and the Columbia Marble Co., Columbia, Tuolumne County. Small amounts of "onyx" and "travertine," chiefly for terrazzo and stucco work, were quarried by the following: John Olson (address, White Water), from the Pipe Canyon quarry in San Bernardino County, near Banning; L. Cardini (address, 121 Fourteenth Street, San Francisco), from the Tolinas quarry, Suisun City, Solano County; and Walter S. McLean (address, 1919 San Bruno Avenue, San Francisco) and the Tuolumne National Marble Co., Sonora, Tuolumne County. It was reported that the Southwest Onyx & Marble Co. (address, San Diego), which owns and operates the New Pedrara onyx quarries at El Marmol, Lower California, Mexico, had leased property containing "onyx" marble in Inyo County, near Trona, and had started production in November, 1929.

Colorado.—The marble quarries at Marble, Gunnison County, owned by the Vermont Marble Co., were operated in 1929 by the Yule Colorado Marble Co.; this marble is sold for interior and exterior building and memorial work and is shipped both in rough blocks and as finished stone. United States Marble Co. (address, Temple Court, Denver) developed and operated marble properties near Salida, Chaffee County, and Canon City, Fremont County, in 1929; the product was sold for terrazzo.

Georgia.—The Georgia Marble Co., at Tate, Pickens County, produced marble for exterior and interior construction and for memorial work; it also quarried "verde antique" (serpentine) near Hollysprings, Cherokee County, and shipped stone for interior building. The American Marble Co. (address, 140 Peachtree Street, Atlanta) operated a marble quarry at Whitestone, Pickens County. The stone was sold in the form of monuments. The Godfrey Marble Co. (address, Atlanta) continued the development of the "Golden Travertine" quarry at Cuthbert, Randolph County, and shipped the stone finished for interior construction.

Maryland.—The Beaver Dam Marble Co. (address, 305 Federal Street, Baltimore) quarried and sold marble for exterior building from quarries at Cockeysville, Baltimore County. The Cockeysville stone was also sold for stucco, grit, agriculture, and other crushed-stone products. Serpentine was quarried near Cardiff, Harford County, by the Cardiff Green Marble Co. This stone was used for interior construction, stucco, terrazzo, and other crushed-stone products.

Massachusetts.—The Lee Marble Works, Lee, Berkshire County, was the only firm quarrying marble in Massachusetts in 1929. The stone was used for monuments and interior and exterior construction. Serpentine was quarried by the Westfield Marble Quarries (Inc.) at Westfield, Hampden County. This stone is all sold to manufacturers in rough blocks.

Missouri.—The production of stone in the Carthage marble district at Carthage, Jasper County, is shown on page 258. This is the largest marble district in Missouri. The quarries are operated by the Carthage Marble Corporation, which ships stone in rough blocks and as sawed and finished stone chiefly for construction but also for monumental work. Other companies operating marble quarries in Missouri are as follows: The Phenix Marble Co. (address, Scarritt Building, Kansas City), Phenix, Greene County, which produced rough and finished stone for exterior and interior construction; the Joplin Marble Quarries Co., in Newton County, near Joplin, which produced rough blocks and finished stone for exterior and interior construction; and the Ozora Marble Quarries Co. (address, Paul Brown Building, St. Louis), Ozora, Ste. Genevieve County, which produced rough blocks for interior work and terrazzo.

Montana.—The Vermont Marble Co. (address, Proctor, Vt.) shipped marble in rough blocks from its quarries near Townsend, Broadwater County, in 1929. The stone was used for interior construction.

New Jersey.—The Rock Products Co. (address, Easton, Pa.) produced serpentine for construction and terrazzo from the Lizzie Clay & Pulp Co. quarry at Phillipsburg, Warren County.

New York.—Marble quarries in New York are operated by the following companies:

Clinton County:
  Bluff Point—Vermont Marble Co. (address, Proctor, Vt.); for interior building; quarry idle in 1929.
  Plattsburg—Day Quarry Co.; stone sold in rough blocks for exterior building.
Dutchess County: Wingdale—South Dover Marble Co. (address, One hundred and thirty-third Street and Walnut Avenue, New York City); stone quarried and shipped in rough blocks for exterior construction.
Putnam County: Patterson—Tuckahoe & Patterson Marble Co.; crushed marble for stucco, artificial stone, etc.
St. Lawrence County:
  Gouverneur—
    DeKalb White Marble Co.; Clarkson quarry; stucco and manufacture of cast stone.
    Gouverneur Marble Co.; construction, monumental, and riprap.
Westchester County:
  Thornwood—Universal Marble Products Corporation; crushed marble for stucco and artificial stone.
  Tuckahoe—
    Benedict Stone Co. (address, 60 East Forty-second Street, New York City); stone crushed and sold for manufacture of cast and artificial stone, stucco, etc.
    Conlin Marble Co. (Inc.); product all sold as crushed or pulverized stone for terrazzo and stucco, as marble dust and flour, and for various other purposes.
    Kapailo Manufacturing Co. (address, Pershing Square Building, New York City); product crushed and sold for manufacture of cast and artificial stone, stucco, poultry grit, etc.

North Carolina.—Marble in the form of rough blocks was shipped in 1929 by the Carolina Marble Quarries (Inc.) (address, Andrews), from a quarry opened recently near Marble, Cherokee County.

Tennessee.—Marble quarries in Blount, Knox, Loudon, and Union Counties in Tennessee were operated in 1929 by the following:

- Blount County:
  - Friendsville—John J. Craig Co. (address, Knoxville); Craig quarry.
  - Kiser—Andres Stone & Marble Co. (address, Milwaukee, Wis.).
  - Louisville—Light Pink Marble Co.; "Anderson Pink" quarry.
- Knox County:
  - Knoxville—
    - Appalachian Marble Co.
    - Bond Marble Co.; "Bond Pink" quarry.
    - John J. Craig Co.; Boyd quarry.
    - Gray Knox Marble Co.; Gray Knox, Consolidated, and Asbury quarries.
    - Knoxville-Gray Eagle Marble Co.
    - Ross-Republic Marble Corporation; Ross quarry.
    - Tennessee Producers Marble Co.; McMullen Gray quarry.
- Lincoln County: Brighton—Tennessee Marble & Brick Co. (address, Fayetteville); stone sold as mill blocks, terrazzo, and marble meal or stucco; quarry idle in 1929.
- Loudon County: Oster—Diamond Marble Co. (address, Friendsville); leased for 1930 to Virginia-Tennessee Marble Co. (address, Friendsville).
- Union County:
  - Luttrell—
    - Knoxville-Gray Eagle Marble Co. (address, Knoxville).
    - Ross-Republic Marble Corporation (address, Knoxville); Republic quarry.

Texas.—A deposit containing black marble in Brewster County, near Marfa, was developed during 1929 by the Marble Mountain Co. No stone was marketed.

Utah.—The "Bird's-eye" quarry of the Mount Nebo Marble Co., at Thistle, Utah County, was operated by Andrew & Reimann, lessee (address, Salt Lake City); the stone was shipped in rough blocks for construction.

Vermont.—Vermont furnishes high-grade marble for building and monumental work. Stone for terrazzo, stucco, paper mills, lime, and other industrial uses is also furnished by the marble quarries. The following firms operate marble quarries in Vermont:

- Franklin County: Swanton—Vermont Marble Co. (address, Proctor); "Champlain Red" marble for interior work produced at this quarry.
- Grand Isle County: Isle La Motte—Vermont Marble Co. (address, Proctor); black marble for interior work produced at this quarry; much of the product shipped to mills of this company at Proctor for finishing.
- Rutland County:
  - Brandon, Danby, Pittsford, Proctor, and West Rutland—Vermont Marble Co. (address, Proctor); marble for exterior and interior building, monuments, and mausoleums shipped from these quarries; greater part of the stone sold from the mills at Proctor as sawed or finished stone. Stone from the other quarries of this company also milled at Proctor and sold from there.
  - Pittsford—Venetian Co. (address, Rutland); rough blocks for monumental work.
  - West Rutland—
    - Colonial Marble Corporation (address, West Rutland); stone for interior and monumental work shipped in rough blocks and as finished stone.
    - Green Mountain Marble Corporation; Clarendon and Baronial quarries; rough stone and dressed stone for exterior and interior building, mausoleums, and monuments sold from the quarries and mills of this company.

Washington County: Roxbury—Vermont Marble Co. (address, Proctor); serpentine (verde antique) produced at this quarry and sold in rough blocks; also shipped to mills of the company, milled, and sold as finished stone.

Windsor County: Rochester—Vermont Marble Co. (address, Proctor); serpentine (verde antique) produced at this quarry and sold in rough blocks; also shipped to mills of the company, milled, and sold as finished stone.

Virginia.—In 1929 a small amount of marble for terrazzo was taken from the quarries of the American Black Marble Corporation, Harrisonburg, Rockingham County.

Washington.—Deposits of serpentine near Chewelah and Valley, Stevens County, are operated intermittently for terrazzo, stucco, cast stone, etc. In 1929 sales of stone for these uses were reported by the following: John Mutti and J. J. Schoenberg, Chewelah; the Manufacturers Mineral Co., 1107 West Idaho Street, Seattle; and J. J. McGrath, Valley.

LIMESTONE

The output of limestone in 1929, as covered by the figures given in this report, amounted to 100,686,960 short tons, valued at $113,906,071, an increase of 4 per cent in quantity and 3 per cent in value over 1928. Crushed stone (road metal, concrete, and railroad ballast) which represented 61 per cent of the total limestone output increased 1 per cent in quantity but decreased 1 per cent in value. Crushed stone for concrete and road metal increased 2 per cent in quantity; that for railroad ballast decreased 4 per cent. Fluxing stone, the next largest limestone product, increased 5 per cent in quantity and 6 per cent in value. Stone for riprap increased 14 per cent in quantity, largely because of the demand for stone for repair work along the Missouri and Mississippi Rivers after the floods of 1928. There was a small increase (1 per cent) in the number of cubic feet of building stone reported. Stone for street work (curbing, flagging, and paving) also increased, as did stone for agricultural limestone, paper mills, alkali works, and many other miscellaneous uses. Decreases were recorded in several of the less important miscellaneous products.

Limestone sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone [1] .... cubic feet..	17, 641, 370	$20, 193, 963	17, 864, 700	$20, 649, 257
Approximate equivalent in short tons......	1, 370, 940	....	1, 312, 820	....
Curbing, flagging, and paving...... cubic feet..	322, 560	205, 724	471, 880	158, 266
Approximate equivalent in short tons......	34, 400	....	37, 940	....
Rubble.......... short tons..	365, 920	705, 723	352, 480	693, 678
Riprap.......... do....	1, 822, 340	1, 765, 147	2, 080, 580	2, 655, 374
Crushed stone.......... do....	60, 952, 500	59, 294, 147	61, 465, 200	58, 934, 450
Fluxing stone.......... do....	23, 094, 090	16, 929, 986	24, 337, 280	17, 994, 110
Sugar factories.......... do....	487, 060	851, 850	487, 990	874, 909
Glass factories.......... do....	281, 260	441, 906	257, 370	455, 367
Paper mills.......... do....	155, 050	290, 590	273, 880	456, 251
Agriculture.......... do....	2, 186, 870	3, 153, 848	2, 654, 580	3, 764, 775
Other uses [2].......... do....	6, 114, 220	6, 399, 090	7, 426, 840	7, 269, 634
Total (quantities approximate, in short tons)..........	96, 864, 650	110, 231, 974	100, 686, 960	113, 906, 071

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[1] Figures for building stone include small amounts of monumental stone.

[2] See table on p. 254 for further distribution of limestone products.

Pennsylvania produced more limestone in 1929 than any other State, followed closely by Ohio. Michigan and New York are the next largest producers. Indiana ranks first in the value of its limestone production on account of its output of high-grade building stone. The following table shows the production of the different States:

Limestone sold or used by producers in the United States, 1928 and 1929, by States

[Quantities approximate]

State	1928		1929	
	Short tons	Value	Short tons	Value
Alabama	1, 167, 830	$1, 368, 315	1, 190, 770	$1, 771, 201
Arizona	84, 740	71, 980	162, 020	147, 619
Arkansas	19, 520	17, 618	132, 760	170, 287
California	224, 550	534, 467	261, 280	653, 681
Colorado	595, 530	563, 215	438, 980	458, 983
Connecticut	30, 910	113, 208	37, 030	112, 891
Florida	3, 368, 600	2, 624, 493	2, 258, 130	1, 669, 245
Georgia	540, 060	649, 514	401, 320	488, 700
Hawaii	(1)	(1)	2, 670	9, 352
Idaho	29, 650	67, 634	29, 820	70, 623
Illinois	9, 645, 370	8, 050, 429	8, 345, 080	6, 965, 264
Indiana	5, 102, 280	22, 720, 411	5, 129, 220	22, 191, 883
Iowa	1, 666, 270	1, 742, 252	1, 624, 400	1, 549, 743
Kansas	1, 203, 270	1, 212, 598	1, 392, 230	1, 413, 146
Kentucky	2, 676, 370	2, 822, 280	2, 443, 880	2, 558, 068
Louisiana	(1)	(1)	(1)	(1)
Maine	92, 100	148, 253	83, 980	130, 125
Maryland	284, 350	421, 355	346, 810	470, 246
Massachusetts	106, 880	329, 231	83, 930	303, 795
Michigan	12, 381, 240	7, 407, 149	13, 572, 010	8, 425, 261
Minnesota	313, 700	710, 478	280, 690	830, 122
Mississippi	(1)	(1)	(1)	(1)
Missouri	3, 277, 800	4, 476, 135	4, 093, 430	5, 704, 241
Montana	105, 770	113, 777	134, 490	140, 164
Nebraska	234, 590	399, 971	178, 200	335, 789
Nevada	(1)	(1)	33, 400	51, 805
New Jersey	163, 490	336, 908	166, 750	368, 504
New Mexico	----------	----------	(1)	(1)
New York	10, 431, 170	13, 139, 230	11, 105, 850	13, 841, 827
North Carolina	225, 460	274, 431	101, 180	202, 416
Ohio	13, 235, 780	10, 903, 862	14, 241, 690	11, 789, 747
Oklahoma	1, 928. 590	1, 570, 824	2, 074, 990	1, 552, 178
Oregon	15, 030	29, 714	23, 800	58, 442
Pennsylvania	13, 048, 120	13, 075, 166	14, 525, 080	14, 024, 287
Porto Rico	79, 730	136. 341	55, 960	90, 675
Rhode Island	(1)	(1)	380	1. 171
South Dakota	60, 940	77, 358	40, 590	55, 513
Tennessee	2, 164, 870	2, 250, 249	2, 249, 440	2, 304, 002
Texas	2, 767. 230	2, 008, 387	3, 238, 760	2, 390, 235
Utah	656, 820	443, 336	203, 530	224, 097
Vermont	45, 550	151, 515	42, 360	129, 251
Virginia	2, 383, 310	2, 442, 046	2, 516, 120	2, 481, 192
Washington	61, 030	97, 145	75, 440	129, 423
West Virginia	3, 139, 040	2, 898, 234	3, 301, 160	2, 978, 873
Wisconsin	2, 655, 100	3, 058, 567	3, 441, 070	3, 882, 645
Wyoming	267, 730	430, 975	322, 260	473, 678
Undistributed	384, 280	342, 923	304, 020	305, 681
	96, 864, 650	110, 231, 974	100, 686, 960	113, 906, 071

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[1] Included under "Undistributed."

Limestone sold or used by producers in the United States in 1929, by States and uses

State	Number of active plants	Building [1]						Rubble		Riprap		Crushed stone			
		Rough construction		Rough architectural		Finished (sawed and cut)						Concrete and road metal		Railroad ballast	
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	15			(2)	(2)	(2)	(2)			1, 150	$995	92, 710	$151, 862	95, 940	$54, 663
Arizona	4											18, 060	21, 557		
Arkansas	8									5, 440	5, 472	115, 030	147, 047	3, 940	4, 143
California	25									(2)	(2)	39, 430	44, 986	200	182
Colorado	18			3, 000	$3, 014							1, 900	1, 935		
Connecticut	4											1, 870	4, 005		
Florida	32	3, 250	$5, 193	(2)	(2)	(2)	(2)	(2)	(2)	3, 330	3, 024	1, 720, 930	1, 242, 687	284, 560	267, 654
Georgia	9											335, 140	323, 918		
Hawaii	1														
Idaho	3														
Illinois	77	3, 310	3, 408	9, 000	15, 000			(2)	(2)	135, 080	132, 971	5, 327, 310	4, 221, 762	936, 240	724, 302
Indiana	85			5, 349, 190	2, 935, 124	9, 087, 590	$15, 651, 380	(2)	(2)	109, 660	34, 422	3, 033, 890	2, 748, 016	467, 490	415, 096
Iowa	44	12, 510	13, 839					2, 110	$2, 952	92, 660	103, 777	1, 158, 490	1, 182, 773	107, 390	45, 809
Kansas	47	14, 250	23, 518	8, 000	3, 200	(2)	(2)	15, 560	17, 699	36, 130	43, 439	778, 530	803, 369	520, 490	460, 329
Kentucky	76	6, 650	9, 102	(2)	(2)			30, 900	101, 700	75, 890	113, 938	1, 414, 860	1, 586, 340	825, 670	606, 508
Louisiana	1									(2)	(2)	(2)	(2)	(2)	(2)
Maine	4														
Maryland	20	(2)	(2)					(2)	(2)			321, 570	396, 640	1, 100	1, 100
Massachusetts	9							(2)	(2)						
Michigan	18									(2)	(2)	2, 218, 550	1, 372, 500	239, 910	158, 554
Minnesota	19	580	1, 613	131, 380	168, 257	110, 100	263, 909	(2)	(2)	46, 780	30, 203	177, 550	193, 942		
Mississippi	3											(2)	(2)	(2)	(2)
Missouri	112	25, 570	42, 522	(2)	(2)			192. 230	377, 541	1, 178, 650	1, 806, 529	2, 238, 580	2, 803, 551	214, 040	193, 952
Montana	6									(2)	(2)	32, 720	32, 391	(2)	(2)
Nebraska	5									65, 470	62, 750	76, 060	80, 677	(2)	(2)
Nevada	3									(2)	(2)				
New Jersey	5											48, 090	68, 714		
New Mexico	1											(2)	(2)		
New York	73	17, 950	19, 074	(2)	(2)	(2)	(2)	(2)	(2)	34, 500	27, 100	8, 579, 080	11, 057, 619	839, 020	742, 361
North Carolina	6											83, 680	117, 021		
Ohio	149	4, 000	4, 573					18, 940	46, 298	10, 900	12, 067	7, 683, 420	6, 582, 316	2, 449, 490	2, 008, 343
Oklahoma	19	(2)	(2)					(2)	(2)	48, 470	38, 539	1, 464, 550	1, 226, 868	552, 760	270, 548
Oregon	3														
Pennsylvania	223	64, 140	87, 044									5, 277, 580	6, 127, 843	50, 570	47, 059
Porto Rico	11	4, 360	6, 480									36, 110	49, 133	70	129

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[1] Figures for building stone include small amounts for monumental work.

[2] Included under "Undistributed."

Limestone sold or used by producers in the United States in 1929, by States and uses—Continued

State	Number of active plants	Building						Rubble		Riprap		Crushed stone			
		Rough construction		Rough architectural		Finished (sawed and cut)						Concrete and road metal		Railroad ballast	
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Rhode Island	1														
South Dakota	7									1,420	$1,001	33,720	$47,373		
Tennessee	34									2,310	3,220	1,067,270	1,127,167	973,270	$763,495
Texas	35	(2)	(2)	166,120	$76,704	(2)	(2)	(2)	(2)	31,950	31,054	1,786,570	1,390,026	1,135,550	754,473
Utah	13			(2)	(2)										
Vermont	8											22,870	42,161	1,360	1,558
Virginia	73	(2)	(2)							(2)	(2)	958,060	946,246	943,010	852,936
Washington	7														
West Virginia	23									(2)	(2)	640,210	644,796	564,220	399,145
Wisconsin	112	10,370	$44,860	144,490	141,907	19,320	$86,937	29,790	$101,356	100,350	113,728	3,068,750	3,000,198	62,980	51,003
Wyoming	8	(2)	(2)							(2)	(2)	(2)	(2)	(2)	(2)
Undistributed		11,550	19,338	381,370	436,433	213,090	486,828	62,950	46,132	100,440	91,145	237,210	269,683	105,580	53,986
	1,459	178,490	280,564	6,192,550	3,779,639	9,430,100	16,589,054	352,480	693,678	2,080,580	2,655,374	50,090,350	50,057,122	11,374,850	8,877,328

State	Fluxing stone		Sugar factories		Glass factories		Paper mills		Agriculture		Other uses		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Alabama	938,260	$750,031							21,170	$28,188	10,560	$43,155	1,190,770	$1,771,201
Arizona	143,960	126,062											162,020	147,619
Arkansas	90	90							8,020	11,541	240	1,994	132,760	170,287
California	33,480	64,410	45,100	$137,900	(2)	(2)			7,270	23,546	124,670	358,404	261,280	653,681
Colorado	362,020	340,541	74,830	113,493									438,980	458,983
Connecticut	(2)	(2)							(2)	(2)	25,250	66,709	37,030	112,891
Florida									(2)	(2)	243,220	120,994	2,258,130	1,669,245
Georgia									33,960	54,381	32,220	110,401	401,320	488,700
Hawaii									2,670	9,352			2,670	9,352
Idaho	(2)	(2)	(2)	(2)					(2)	(2)	(2)	(2)	29,820	70,623
Illinois	786,020	749,721			(2)	(2)			947,800	843,693	199,540	257,364	8,345,080	6,965,264
Indiana	132,060	27,397			(2)	(2)			154,590	176,514	86,780	111,479	5,129,220	22,191,883

Iowa	10,160	17,923	(2)	(2)					193,050	159,752	(2)	(2)	1,624,400	1,549,743
Kansas									18,640	23,450	(2)	(2)	1,392,230	1,413,146
Kentucky	(2)	(2)							79,690	87,819	6,110	24,351	2,443,880	2,558,068
Louisiana													(2)	(2)
Maine	35,700	34,627					27,830	$68,034	110	700	20,340	26,764	83,980	130,125
Maryland	660	662							970	2,682	13,340	54,407	346,810	470,246
Massachusetts	14,810	23,880					(2)	(2)	47,030	206,705	17,300	65,227	83,930	303,795
Michigan	7,365,300	4,599,447	12,400	18,800	(2)	(2)	(2)	(2)	182,660	187,500	3,430,700	1,921,103	13,572,010	8,425,261
Minnesota	(2)	(2)							22,460	23,227	6,060	30,954	280,690	830,122
Mississippi									(2)	(2)			(2)	(2)
Missouri	21,920	24,287	(2)	(2)	(2)	(2)			131,860	161,838	54,100	200,477	4,093,430	5,704,241
Montana	57,180	51,207	21,810	40,883									134,490	140,164
Nebraska	(2)	(2)			(2)	(2)			(2)	(2)	26,330	178,073	178,200	335,789
Nevada	(2)	(2)	(2)	(2)									33,400	51,805
New Jersey	(2)	(2)							28,500	85,448	(2)	(2)	166,750	368,504
New Mexico													(2)	(2)
New York	197,000	178,406					24,430	58,584	84,430	286,848	1,327,020	1,425,873	11,105,850	13,841,827
North Carolina	(2)	(2)							16,730	83,350	(2)	(2)	101,180	202,416
Ohio	3,207,250	2,088,776	(2)	(2)	41,240	$78,545	(2)	(2)	231,630	372,500	590,840	591,878	14,241,690	11,789,747
Oklahoma					(2)	(2)			(2)	(2)	(2)	(2)	2,074,990	1,552,178
Oregon							(2)	(2)	(2)	(2)			23,800	58,442
Pennsylvania	8,621,270	6,721,767			98,560	177,838	30,650	35,015	67,910	221,083	314,400	606,638	14,525,080	14,024,287
Porto Rico			(2)	(2)					6,080	24,633	(2)	(2)	55,960	90,675
Rhode Island	380	1,171											380	1,171
South Dakota			(2)	(2)							(2)	(2)	40,590	55,513
Tennessee	40,710	38,601							119,260	216,743	46,620	154,776	2,249,440	2,304,002
Texas	(2)	(2)			(2)	(2)			(2)	(2)	238,690	102,527	3,238,760	2,390,235
Utah	168,520	141,163	(2)	(2)					(2)	(2)	2,880	13,910	203,530	224,097
Vermont	(2)	(2)					(2)	(2)	(2)	(2)	5,280	27,834	42,360	129,251
Virginia	97,990	95,055					(2)	(2)	113,540	168,599	376,180	395,012	2,516,120	2,481,192
Washington	18,790	16,259	(2)	(2)	(2)	(2)	44,450	75,390	(2)	(2)	1,840	12,649	75,440	129,423
West Virginia	1,971,460	1,782,638			(2)	(2)			17,460	39,356	99,760	97,793	3,301,160	2,978,873
Wisconsin	11,890	9,579							67,510	122,882	76,430	210,195	3,441,070	3,882,645
Wyoming	(2)	(2)	221,830	386,408									322,260	473,678
Undistributed	100,400	110,410	112,020	177,425	117,570	198,984	146,520	219,228	49,580	142,445	88,080	216,959	304,020	305,681
	24,337,280	17,994,110	487,990	874,909	257,370	455,367	273,880	456,251	2,654,580	3,764,775	7,464,780	7,427,900	100,686,960	113,906,071

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[2] Included under "Undistributed."

Limestone sold or used by producers in the United States for miscellaneous uses, 1928 and 1929

Use	1928		1929	
	Short tons	Value	Short tons	Value
Alkali works	4, 231, 750	$2, 585, 216	5, 004, 930	$3, 234, 457
Asphalt filler	407, 350	1, 284, 983	344, 880	1, 165, 538
Calcium carbide works	282, 610	178, 902	339, 510	236, 412
Carbonic acid works	4, 690	10, 899	4, 560	10, 708
Coal mine dusting	54, 460	140, 023	34, 650	121, 712
Filter beds	41, 230	63, 715	72, 870	63, 277
Magnesia works (dolomite)	94, 200	122, 260	84, 750	129, 383
Mineral food	39, 460	180, 662	25, 270	96, 009
Mineral (rock) wool	31, 700	27, 042	83, 920	92, 092
Poultry grit	18, 110	137, 479	34, 600	221, 610
Refractory stone (dolomite)	522, 850	509, 502	516, 400	461, 444
Road base	11, 500	6, 900	494, 250	213, 802
Roofing gravel	5, 950	12, 717	4, 950	10, 968
Stucco, terrazzo, and artificial stone	77, 850	354, 145	85, 540	292, 313
Whiting substitute	95, 400	442, 742	125, 430	626, 692
Other uses [1]	195, 110	341, 903	170, 330	293, 217
	6, 114, 220	6, 399, 090	7, 426, 840	7, 269, 634

[1] Includes stone for ammonia, baking powder, lime burners, nitrates, phosphates, powder, purification of copper, reduction of aluminum ore, soap, sulphuric acid, and uses not specified.

A considerable quantity of the limestone reported in the tables by uses is burned into lime—particularly the limestone reported by iron and steel producers and by alkali, sugar, and paper manufacturers as quarried by them and used in their own plants; also limestone sold to manufacturers of these and other commodities, who may burn it into lime before using it. To avoid duplication, this lime is not included in the figures of production in the chapter on lime. Limestone manufactured into lime and into cement and reported in terms of finished product is treated in separate chapters. The quantities so used are estimated in the following table.

Limestone used for all purposes in the United States, 1925–1929, in short tons

Use	1925	1926	1927	1928	1929
Limestone (as given in this report)	85, 649, 440	91, 887, 900	99, 662, 270	96, 864, 650	100, 686, 960
Portland cement (including "cement rock")	40, 720, 000	41, 583, 000	43, 800, 000	44, 600, 000	43, 200, 000
Natural cement ("cement rock")	292, 000	391, 000	395, 000	412, 000	412, 000
Lime	9, 100, 000	9, 121, 000	8, 830, 000	8, 920, 000	8, 540, 000
	135, 761, 440	142, 982, 900	152, 687, 270	150, 796, 650	152, 838, 960

BUILDING STONE

Of the total quantity of building stone reported in 1929, 51 per cent (17,864,700 cubic feet) was limestone, which increased 1 per cent in quantity over 1928. The high-grade limestone classed as architectural building stone is obtained from a few well-known localities. Such figures as are available covering the output of these districts for a series of years are given in the tables that follow.

Alabama.—Oolitic limestone used as high-grade building stone is quarried at Rockwood, near Russellville, Franklin County, by the Alabama-Oolitic Stone Co. (address, First National Bank Building, Nashville, Tenn.) and the Rockwood Alabama Stone Co. (address, Fuller Building, New York City).

Colorado.—Limestone (travertine) sold in rough blocks for architectural building has been quarried for several years in Fremont County, near Salida (Wellsville quarry), by the Natural Resources Exploration Co. (address, Continental Oil Building, Denver). It is reported that this company will be succeeded by the Colorado Travertine Co.

Florida.—The Florida Travertine Corporation (address, 4417 Chrysler Building, New York City) shipped stone ("Floridene Stone") in 1929 for the first time from quarries recently developed at Bradenton, Manatee County. This stone is shipped in rough blocks and as finished stone. The Clark Quarries (address, National Gardens) near Volusia, Volusia County, quarries coquina rock for construction.

Indiana.—The largest quarry center for building stone in the United States is the oolitic limestone district near Bedford, Lawrence County, and Bloomington, Monroe County, Ind. In 1929 the output of building stone in this district decreased 4 per cent in quantity and 2 per cent in value from 1928. The quarry operators in the district in 1929 and their addresses were as follows:

The Carl Furst Co., Heltonville Limestone Co., Indiana Limestone Co., and Reed-Powers Cut Stone Co., Bedford; Bloomington Limestone Co., Empire Stone Co., Hoadley Bros. (Inc.), B. G. Hoadley Quarries (Inc.), Hunter Bros. Stone Co., Independent Limestone Co., Indiana Oolitic Limestone Co., Indian Hill Stone Co., Alexander King Stone Co., Monon Stone Co., Sare-Hoadley Stone Co., Shawnee Stone Co., and H. A. Woolery & Son, Bloomington; Bloomington & Ellettsville Stone Co. and Perry Stone Co., Ellettsville; Indianapolis Oolitic Stone Co., Stinesville; and Victor Oolitic Stone Co., Victor.

Other operators of high-grade building stone quarries in Indiana in 1929 were the Ingalls Stone Co. (address, Bedford), Romona, Owen County, and The St. Paul Stone Quarries Co., St. Paul.

The statistics of production for the Bedford-Bloomington district for a series of years follow.

Limestone sold by producers in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1920–1929

Year	Construction		Other		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1920	6, 343, 536	$7, 286, 679	278, 235	$293, 200	738, 000	$7, 579, 879
1921	5, 297, 458	6, 815, 859	141, 068	146, 425	525, 000	6, 962, 284
1922	9, 616, 670	11, 288, 823	214, 722	139, 233	912, 000	11, 428, 056
1923	11, 694, 380	15, 248, 164	233, 180	167, 845	1, 081, 080	15, 416, 009
1924	11, 005, 570	14, 164, 241	255, 930	200, 512	1, 053, 730	14, 364, 753
1925	11, 803, 890	14, 203, 120	290, 990	170, 772	1, 146, 790	14, 373, 892
1926	14, 171, 490	18, 063, 148	405, 630	354, 703	1, 432, 480	18, 417, 851
1927	13, 572, 950	16, 407, 170	423, 320	381, 455	1, 407, 360	16, 788, 625
1928	14, 520, 260	17, 760, 622	429, 890	302, 819	1, 482, 610	18, 063, 441
1929	14, 009, 850	17, 419, 183	414, 140	250, 578	1, 429, 840	17, 669, 761

Limestone sold by producers in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1928 and 1929, by classes

Class	1928		1929	
	Quantity	Value	Quantity	Value
Construction:				
Rough blocks cubic feet	4, 520, 320	$2, 696, 376	5, 345, 390	$2, 931, 816
Sawed do	5, 745, 020	4, 128, 388	4, 361, 670	3, 697, 731
Semifinished do	180, 050	353, 633	174, 390	375, 720
Cut do	4, 074, 870	10, 582, 225	4, 128, 400	10, 413, 916
Total construction do	14, 520, 260	17, 760, 622	14, 009, 850	17, 419, 183
Other stone short tons	429, 890	302, 819	414, 140	250, 578
Grand total (quantities approximate, in short tons)	1, 482, 610	18, 063, 441	1, 429, 840	17, 669, 761

A considerable amount of stone is sold by quarry operators to the finishing mills of the district, and a few of the quarry operators who operate mills obtain rough stone from other quarries, mill it, and resell it. Duplication is avoided by including this milled product in the table showing the output of the mills in the district, whereas the rough stone involved is included in the quarry report of the producing company. The names and addresses of mills in the Bedford-Bloomington district operating in 1929 on stone purchased from quarry operators were as follows:

Bedford Cut Stone Co., The Edward Edinger Co., J. P. Falt Co., The Carl Furst Co., and Ingalls Stone Co., Bedford; Matthews Bros. Co., Mutual Oolitic Stone Co., and Walker Bros. Stone Co., Bloomington; Ellettsville Stone Co., Harding & Cogswell (Inc.), and A. J. Thompson Stone Co., Ellettsville; and Swenson Stone Co., Stinesville.

Indiana oolitic limestone sold by mills not operated by quarry companies in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1920–1929 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1920	836, 298	$2, 112, 384	1925	2, 087, 860	$5, 629, 269
1921	1, 030, 177	2, 691, 931	1926	1, 511, 250	4, 073, 271
1922	1, 508, 100	3, 706, 900	1927	1, 670, 470	3, 646, 445
1923	1, 676, 500	4, 805, 537	1928	1, 177, 320	2, 594, 224
1924	1, 754, 500	4, 654, 145	1929	1, 370, 200	3, 374, 490

[1] Includes some stone purchased by quarry operators and milled and resold.

Indiana oolitic limestone sold by mills not operated by quarry companies in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1928 and 1929, by classes [1]

Year	Sawed		Semifinished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1928	322, 645	$284, 034	31, 750	$50, 526	822, 925	$2, 259, 664	1, 177, 320	$2, 594, 224
1929	[2] 208, 660	[2] 148, 777	(2)	(2)	1, 161, 540	3, 225, 713	1, 370, 200	3, 374, 490

[1] Includes some stone purchased by quarry operators and milled and resold.
[2] Semifinished stone included under sawed stone.

Kansas.—The Arkansas City Sand & Gravel Co. (address, Arkansas City, Kans.) produces stone for rough and sawed architectural work from quarries near Silverdale, Cowley County.

Kentucky.—The oolitic limestone quarried at Bowling Green, Warren County, Ky., is well known to the trade. It is quarried for building and monumental stone by the Bowling Green Quarries Co. and by William Murphy. There are also several quarries in the vicinity operated for crushed stone. The following table shows the production of the county for the last 10 years.

Limestone sold by producers in Warren County, Ky., 1920–1929

Year	Building and monumental stone (rough and dressed)		Other		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1920	98,700	$123,010	7,480	$12,420	15,600	$135,430
1921	128,000	170,540	6,230	5,840	16,800	176,380
1922	91,400	143,012	5,200	7,000	12,740	150,012
1923	65,980	113,040	24,380	28,915	29,660	141,955
1924	65,630	120,882	10,000	10,000	14,920	130,882
1925	128,700	226,646	27,200	61,260	37,500	287,906
1926	[1] 134,460	[1] 63,458	10,340	10,130	21,000	73,588
1927	[1] 198,770	[1] 119,054	73,350	86,400	87,660	205,454
1928	[1] 116,180	[1] 82,648	52,920	80,896	61,290	163,544
1929	[1] 30,620	[1] 27,251	7,000	10,500	9,200	37,751

[1] Rough blocks only.

Minnesota.—The following table shows the sales of limestone at Mankato and Kasota, Minn., for the last 10 years.

Limestone sold by producers at Mankato and Kasota, Minn., 1920–1929

Year	Building stone (rough and dressed)		Other		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1920	104,865	$132,170	39,564	$54,485	47,900	$186,655
1921	111,487	271,230	32,627	41,409	41,500	312,639
1922	151,110	261,275	29,910	32,329	42,600	293,604
1923	138,890	312,911	33,980	34,867	44,900	347,778
1924	130,660	495,036	46,610	43,152	65,560	538,188
1925	320,050	586,451	66,060	60,179	91,380	646,630
1926	245,330	638,284	58,050	32,655	77,410	670,939
1927	199,640	414,350	41,990	26,766	57,760	441,116
1928	184,610	339,291	30,900	19,850	45,560	359,141
1929	230,290	495,895	38,410	22,962	56,590	518,857

T. R. Coughlan Co. and The Mankato Lime Co., Mankato, and Babcock & Wilcox and Breen Stone & Marble Co., Kasota, are the producers of the Mankato and Kasota stone. The Biesanz Stone Co. quarries architectural building stone at Winona. This stone is marketed as "Travertine."

Missouri.—The stone quarried at Carthage, Jasper County, and used for architectural building and monumental stone is classed as marble and is included in the figures of production of marble in Missouri given on page 245. Its chief use is, however, as is that of the Indiana stone, mainly for exterior building; the figures of production are given here for convenience in comparison. The crushed stone and low-grade material are included under limestone. All grades are combined here to show the total production.

The Carthage Marble Corporation operates the dimension-stone quarries. The crushing plants are operated independently.

Stone for architectural construction was also reported by the Carthage Stone Co. (address, Carthage) from a quarry opened recently near South Greenfield, Dade County.

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1920-1929

Year	Building stone (rough and dressed)		Monumental stone (rough and dressed)		Other		Total	
	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1920	295, 341	$589, 213	86, 791	$158, 440	56, 292	$190, 529	129, 700	$938, 182
1921	279, 560	587, 301	31, 551	77, 421	46, 751	152, 521	72, 600	817, 243
1922	368, 400	692, 693	26, 330	40, 471	68, 550	176, 852	102, 300	910, 016
1923	442, 680	782, 796	20, 630	32, 243	66, 070	167, 357	104, 760	982, 396
1924	435, 810	826, 294	25, 660	40, 505	78, 030	193, 944	116, 560	1, 060, 743
1925	478. 210	1, 012, 930	38, 810	85, 321	224, 270	304, 913	267, 450	1, 403, 164
1926	426, 950	975, 754	32, 630	80, 698	127, 330	220, 780	165, 700	1, 277, 232
1927	339, 260	724, 265	10, 740	17, 429	93, 480	151, 795	122, 710	893, 489
1928	450, 670	1, 009, 927	14, 720	23, 231	118, 130	182, 171	156, 890	1, 215, 329
1929	278, 340	553, 468	21, 610	43, 202	174, 810	228, 941	199, 860	825, 611

New York.—Onondaga limestone for building stone is quarried near Syracuse, Onondaga County, by the Jones Cut Stone Co.

Texas.—There was considerable activity in the building-stone quarries in Texas during 1929, and the following companies either operated or developed building-stone quarries during the year.

Jones County:
  Lueders—
    Bedford Carthage Stone Corporation (address, Houston).
    A. C. Fox.
    Lueders Building Stone Co. (Post Oak quarry).
Kinney County: Del Rio (near)—Del Rio Stone Co. (address, Marine Bank Building, Houston).
Williamson County:
  Cedar Park—
    E. Cluck.
    Texas Quarries (Inc.) (address, Austin).

Utah.—A small amount of oolitic limestone is produced annually near Ephraim, Sanpete County, by the Parry Bros. Stone Co. (address, Manti) and the San Pete White Stone Co.

Wisconsin.—Limestone for building, in the form of dimension stone, was produced in Wisconsin in 1929 by the following:

Milwaukee County: Wauwatosa—F. Hartung Co.
Waukesha County:
  Lannon—
    Davis Bros. Stone Co.
    Lannon Quarries Corporation (address, Beaver Dam).
    Schneider Stone Co.
    Wisconsin Lannon Stone Co. (address, Milwaukee).

A considerable amount of stone for curbing and flagstone is also produced from quarries in this vicinity.

SANDSTONE

The output of sandstone in 1929 amounted to 5,790,200 short tons, valued at $11,023,981, an increase of 23 per cent in quantity and 5 per cent in value over 1928. There were increases in the amount of stone sold for construction, paving blocks, crushed stone, riprap, refractory use, and miscellaneous uses and decreases in that sold for curbing, flagging, and rubble. As may be noted on page 231, the increase in stone for construction was chiefly in stone sold for rough construction and was due largely to the increase in the quantity of stone reported sold for that purpose from quarries in Ohio.

Sandstone sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone........cubic feet..	2,622,690	$2,643,277	4,870,670	$2,666,314
Approximate equivalent in short tons........	200,490	----------	347,440	----------
Paving blocks........number..	2,477,560	178,922	3,674,800	291,608
Approximate equivalent in short tons........	27,990	----------	40,890	----------
Curbing........cubic feet..	2,301,410	1,939,736	2,092,210	1,668,541
Approximate equivalent in short tons........	169,930	----------	167,660	----------
Flagging........cubic feet..	832,900	662,750	729,230	557,720
Approximate equivalent in short tons........	63,570	----------	55,770	----------
Crushed stone........short tons..	2,616,660	2,845,791	3,171,750	3,298,779
Rubble........do....	90,650	114,603	43,840	102,524
Riprap........do....	664,660	850,158	864,380	1,092,870
Refractory stone (ganister)........do....	790,630	1,098,945	1,004,400	1,200,634
Other uses........do....	91,950	164,258	94,070	144,991
Total (quantities approximate, in short tons)......	4,716,530	10,498,440	5,790,200	11,023,981

Sandstone sold or used by producers in the United States, 1928 and 1929, by States

[Quantities approximate]

State	1928		1929	
	Short tons	Value	Short tons	Value
Alabama........	30,960	$36,675	30,450	$34,881
Arizona........	----------	----------	(1)	(1)
Arkansas........	(1)	(1)	(1)	(1)
California........	835,940	852,559	897,020	886,530
Colorado........	51,120	69,470	36,520	51,268
Connecticut........	21,920	78,568	(1)	(1)
Georgia........	(1)	(1)	----------	----------
Idaho........	(1)	(1)	(1)	(1)
Illinois........	83,550	47,961	62,650	37,944
Kansas........	(1)	(1)	27,660	48,000
Kentucky........	33,990	70,146	3,660	29,524
Maryland........	----------	----------	(1)	(1)
Massachusetts........	(1)	(1)	(1)	(1)
Michigan........	----------	----------	14,220	29,441
Minnesota........	17,500	49,396	20,640	52,967
Missouri........	(1)	(1)	196,830	322,508
Montana........	11,240	24,171	790	1,186
New Jersey........	36,460	51,334	(1)	(1)
New Mexico........	(1)	(1)	(1)	(1)
New York........	[2] 143,240	[2] 1,221,775	[2] 317,880	[2] 1,120,552
North Carolina........	----------	----------	(1)	(1)
Ohio........	415,430	3,226,342	479,580	3,118,276
Oklahoma........	(1)	(1)	3,840	2,110
Oregon........	328,850	413,949	481,990	534,847
Pennsylvania........	[2] 1,462,570	[2] 2,437,440	[2] 1,696,290	[2] 2,767,864
South Dakota........	94,380	127,313	193,470	274,482
Tennessee........	(1)	(1)	(1)	(1)
Texas........	(1)	(1)	----------	----------
Utah........	221,420	347,815	----------	----------
Virginia........	118,420	143,220	159,930	168,785
Washington........	10,680	215,192	233,550	325,109
West Virginia........	4,740	10,423	74,430	77,301
Wisconsin........	194,180	396,588	208,070	365,656
Wyoming........	12,450	23,161	----------	----------
Undistributed........	587,490	654,942	650,730	774,750
	4,716,530	10,498,440	5,790,200	11,023,981

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[1] Included under "Undistributed."

[2] Includes bluestone.

Sandstone sold or used by producers in the United States in 1929, by States and uses

State	Number of active plants	Building stone						Refractory stone (ganister)		Paving blocks		Curbing	
		Rough construction		Rough architectural		Dressed (sawed and cut)							
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Number	Value	Cubic feet	Value
Alabama	3							30, 450	$34, 881				
Arizona	2												
Arkansas	1												
California	7	1, 100	$7, 100	4, 600	$6, 795			(1)	(1)				
Colorado	5							23, 390	35, 853	(1)	(1)	(1)	(1)
Connecticut	2	(1)	(1)	(1)	(1)	(1)	(1)						
Idaho	2	(1)	(1)	(1)	(1)	(1)	(1)						
Illinois	3							960	4, 156				
Kansas	2												
Kentucky	2					29, 250	$29, 075						
Maryland	2												
Massachusetts	2			(1)	(1)	(1)	(1)					(1)	(1)
Michigan	2	40	104	80	127								
Minnesota	4			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)		
Missouri	3												
Montana	1							790	1, 186				
New Jersey	2			(1)	(1)								
New Mexico	1												
New York	50	5, 400	20, 945	31, 510	21, 265	61, 750	208, 216			756, 760	$45, 639	421, 760	$439, 919
North Carolina	1			(1)	(1)								
Ohio	19	224, 560	257, 390	285, 130	169, 606	694, 040	1, 342, 057	2, 340	5, 579			1, 438, 520	997, 170
Oklahoma	3												
Oregon	7												
Pennsylvania	87	10, 700	24, 432	26, 630	38, 491	67, 160	136, 317	686, 840	804, 037	2, 868, 320	240, 174	230, 570	230, 584
South Dakota	8	(1)	(1)			(1)	(1)	(1)	(1)				
Tennessee	2												
Virginia	6	(1)	(1)	(1)	(1)	(1)	(1)						
Washington	9	(1)	(1)			(1)	(1)	(1)	(1)				
West Virginia	7	(1)	(1)					(1)	(1)				
Wisconsin	13	1, 070	1, 290	16, 260	20, 262	9, 610	17, 026	167, 500	214, 298				
Undistributed		4, 210	9, 369	59, 260	75, 492	96, 170	280, 955	92, 130	100, 644	49, 720	5, 795	1, 360	868
	258	247, 080	320, 630	423, 470	332, 038	957, 980	2, 013, 646	1, 004, 400	1, 200, 634	3, 674, 800	291, 608	2, 092, 210	1, 668, 541

State	Flagging		Rubble		Riprap		Crushed stone				Other uses		Total	
							Concrete and road metal		Railroad ballast					
	Cubic feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Alabama													30, 450	$34, 881
Arizona					(1)	(1)							(1)	(1)
Arkansas							(1)	(1)	(1)	(1)			(1)	(1)
California	2, 860	$1, 800			(1)	(1)	607, 340	$601, 503	224, 200	$182, 045	26, 880	$5, 547	897, 020	886, 530
Colorado	1, 270	720	(1)	(1)			9, 390	9, 394			2, 290	1, 455	36, 520	51, 268
Connecticut					(1)	(1)	(1)	(1)					(1)	(1)
Idaho	(1)	(1)	(1)	(1)							(1)	(1)	(1)	(1)
Illinois							61, 690	33, 788					62, 650	37, 944
Kansas	8, 250	3, 000					27, 000	45, 000					27, 660	48, 000
Kentucky					1, 230	$449							3, 660	29, 524
Maryland	(1)	(1)					(1)	(1)					(1)	(1)
Massachusetts			(1)	(1)			(1)	(1)					(1)	(1)
Michigan							11, 320	26, 103			2, 850	3, 107	14, 220	29, 441
Minnesota			(1)	(1)	(1)	(1)	15, 530	20, 605			3, 000	22, 500	20, 640	52, 967
Missouri					196, 830	322, 508							196, 830	322, 508
Montana													790	1, 186
New Jersey					(1)	(1)							(1)	(1)
New Mexico									(1)	(1)			(1)	(1)
New York	118, 850	91, 083	100	$150	7, 220	6, 058	206, 090	276, 777			26, 250	10, 500	317, 880	1, 120, 552
North Carolina													(1)	(1)
Ohio	369, 990	266, 803	17, 740	43, 644	8, 550	3, 012	9, 700	14, 100			21, 390	18, 915	479, 580	3, 118, 276
Oklahoma			840	850			3, 000	1, 260					3, 840	2, 110
Oregon					459, 190	516, 991	22, 800	17, 856					481, 990	534, 847
Pennsylvania	168, 110	131, 539	14, 440	27, 915	5, 040	16, 433	362, 180	424, 223	539, 270	675, 503	4, 160	18, 216	1, 696, 290	2, 767, 864
South Dakota			(1)	(1)	5, 180	5, 255	167, 900	222, 475					193, 470	274, 482
Tennessee	(1)	(1)	(1)	(1)									(1)	(1)
Virginia							71, 410	52, 116	84, 690	47, 554			159, 930	168, 785
Washington	(1)	(1)	(1)	(1)	4, 560	2, 278	225, 850	226, 915					233, 550	325, 109
West Virginia							4, 490	8, 910					74, 430	77, 301
Wisconsin	(1)	(1)	(1)	(1)	(1)	(1)	25, 170	43, 096			(1)	(1)	208, 070	365, 656
Undistributed	59, 900	62, 775	10, 720	29, 965	176, 580	219, 886	118, 570	178, 197	374, 160	191, 359	7, 250	64, 751	650, 730	774, 750
	729, 230	557, 720	43, 840	102, 524	864, 380	1, 092, 870	1, 949, 430	2, 202, 318	1, 222, 320	1, 096, 461	94, 070	144, 991	5, 790, 200	11, 023, 981

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[1] Included under "Undistributed."

BLUESTONE

The figures for bluestone are included in those for sandstone, but on account of the local importance of this stone they are also given separately. Except for a few of the large quarries, the Bureau of Mines uses the figures of sales reported by dealers, rather than those of the quarrymen, as more nearly representative of this industry.

Bluestone sold in New York and Pennsylvania, 1928 and 1929

State	Building stone		Curbing		Flagging		Other		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1928										
New York	119,860	$226,926	332,560	$418,714	183,410	$116,161	9,130	$12,996	62,860	$774,797
Pennsylvania	13,210	7,537	93,510	94,681	148,640	150,824	110	359	21,690	253,401
	133,070	234,463	426,070	513,395	332,050	266,985	9,240	13,355	84,550	1,028,198
1929										
New York	84,170	214,386	241,260	259,118	116,390	89,283	9,220	9,058	46,480	571,845
Pennsylvania	7,950	19,975	72,940	66,628	147,310	124,142	240	1,345	19,520	212,090
	92,120	234,361	314,200	325,746	263,700	213,425	9,460	10,403	66,000	783,935

MISCELLANEOUS STONE

The material included under "miscellaneous" stone is mainly for concrete, road metal, and railroad ballast. Because of the nature and irregularity of production of materials in this classification the output is apt to vary greatly. In 1929 there was an increase of 23 per cent in quantity and 34 per cent in value over 1928.

The State contributing the largest amount of miscellaneous stone is California. The output of this State includes rhyolite tuff (used as a building stone), andesite, rhyolite, trachyte, and other light-colored volcanic rocks, decomposed granite, hornblende-mica schist, and stone crushed from bowlders taken from river beds. The crushed bowlders are mostly from Los Angeles County, where part of the material taken out is sand, part screened gravel, and the rest chiefly bowlders which are crushed. The sand and screened gravel obtained are included in the report of this series on sand and gravel. Among the varieties of stone reported are argillite quarried in Arkansas, New Jersey, and Pennsylvania; phonolite from mine dumps in Colorado; cherty limestone or flint rock in Florida; rhyolite in Missouri; slate, conglomerate, and light-colored volcanic rocks in Massachusetts; and mica schist for building and refractory stone in Pennsylvania. There are also included from the other States volcanic cinders, coral rock, rhyolite, andesite, decomposed granite, mica crystal grit, serpentine, graywacke, "gyp" rock, caliche, field stone, and some stone of unknown kinds reported by local contractors or operators of portable crushers at temporary quarry sites.

Miscellaneous varieties of stone[1] *sold or used by producers in the United States, 1928 and 1929, by uses*

Use	1928		1929	
	Quantity	Value	Quantity	Value
Building stone cubic feet	486,400	$91,049	2,556,900	$293,010
Approximate equivalent in short tons	37,830		200,380	
Riprap and rubble short tons	500,250	284,299	277,660	114,892
Crushed stone do	5,960,100	5,295,820	7,830,780	7,363,683
Refractory stone (mica schist) do	34,680	136,619	37,400	145,246
Other uses do	291,720	191,038	34,030	129,260
Total (quantities approximate, in short tons)	6,824,580	5,998,825	8,380,250	8,046,091

[1] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

Miscellaneous varieties of stone sold or used by producers in the United States, 1928 and 1929, by States

[Quantities approximate]

State	1928		1929	
	Short tons	Value	Short tons	Value
Arizona	271,760	$76,882	329,590	$298,012
Arkansas	305,350	335,802	318,000	410,480
California	3,801,990	2,967,232	5,880,910	5,146,513
Colorado	264,980	94,771	322,040	116,977
Florida	12,870	29,877	9,010	18,979
Idaho	(1)	(1)	87,770	37,958
Indiana	(1)	(1)		
Maine	41,170	72,895	41,810	83,889
Maryland			20,680	39,575
Massachusetts	403,340	720,436	376,370	602,526
Minnesota	(1)	(1)		
Missouri	(1)	(1)	42,360	71,461
Montana	(1)	(1)	(1)	(1)
Nevada	824,910	601,664		
New Hampshire	(1)	(1)	(1)	(1)
New Jersey	(1)	(1)		
New Mexico			20,930	21,193
New York			(1)	(1)
North Carolina	32,240	73,800	(1)	(1)
Ohio	66,200	65,403	49,760	49,211
Oklahoma	20,510	16,410		
Oregon	(1)	(1)		
Pennsylvania	246,370	463,500	218,750	422,183
Rhode Island	(1)	(1)	98,560	165,761
South Dakota	4,340	4,050	4,430	5,761
Texas	140,870	80,841	388,960	371,549
Utah	(1)	(1)	2,660	11,595
Vermont	(1)	(1)	(1)	(1)
Virginia			(1)	(1)
Washington	23,280	14,087		
West Virginia	(1)	(1)		
Wisconsin	(1)	(1)	(1)	(1)
Wyoming	(1)	(1)		
Undistributed	364,400	381,175	167,660	172,468
	6,824,580	5,998,825	8,380,250	8,046,091

[1] Included under "Undistributed."

Miscellaneous varieties of stone sold or used by producers in the United States in 1929, by States and uses

State	Number of active plants	Building		Riprap and rubble		Crushed stone				Other uses		Total	
						Concrete and road metal		Railroad ballast					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Arizona	7	(1)	(1)	(1)	(1)	237,290	$263,914					329,590	$298,012
Arkansas	3			(1)	(1)	188,000	255,480	(1)	(1)			318,000	410,480
California	97	178,010	$256,091	85,180	$24,900	5,229,760	4,559,694	367,910	$254,854	20,050	$50,974	5,880,910	5,146,513
Colorado	5			960	480	137,290	79,396	183,790	37,101			322,040	116,977
Florida	3			(1)	(1)	7,600	17,606			(1)	(1)	9,010	18,979
Idaho	4	70	35	57,450	13,723	30,250	24,200					87,770	37,958
Maine	6					41,810	83,889					41,810	83,889
Maryland	3	(1)	(1)			(1)	(1)			(1)	(1)	20,680	39,575
Massachusetts	12	2,030	4,034			374,340	598,492					376,370	602,526
Missouri	2					42,360	71,461					42,360	71,461
Montana	1							(1)	(1)			(1)	(1)
New Hampshire	1					(1)	(1)			(1)	(1)	(1)	(1)
New Mexico	3					20,930	21,193					20,930	21,193
New York	1					(1)	(1)					(1)	(1)
North Carolina	1					(1)	(1)					(1)	(1)
Ohio	5					48,960	45,211			800	4,000	49,760	49,211
Pennsylvania	18	11,200	18,875			161,800	217,624	1,000	1,600	44,750	184,084	218,750	422,183
Rhode Island	5					98,560	165,761					98,560	165,761
South Dakota	3					4,430	5,761					4,430	5,761
Texas	10			290	218	260,570	291,129	128,100	80,202			388,960	371,549
Utah	1									2,660	11,595	2,660	11,595
Vermont	1					(1)	(1)					(1)	(1)
Virginia	1	(1)	(1)									(1)	(1)
Wisconsin	1					(1)	(1)					(1)	(1)
Undistributed		9,070	13,975	133,780	75,571	178,570	178,535	87,460	110,580	3,170	23,853	167,660	172,468
	194	200,380	293,010	277,660	114,892	7,062,520	6,879,346	768,260	484,337	71,430	274,506	8,380,250	8,046,091

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[1] Included under "Undistributed."

CRUSHED STONE (CONCRETE AND ROAD METAL AND RAILROAD BALLAST)

The crushed stone sold or used by producers for concrete and road metal and for railroad ballast in the United States in 1929 amounted to 92,721,260 short tons, valued at $94,387,878. These figures represent an increase of 1.6 per cent in quantity and less than 1 per cent in value from 1928. Crushed stone for concrete and road metal increased 2 per cent in quantity but decreased slightly in value, and railroad ballast decreased 2 per cent in quantity but increased 4 per cent in value, compared with 1928. The total average value was $1.02 in 1929, 1 cent less than in 1928. The average value of crushed stone for concrete and road metal ($1.06) was 3 cents less and that for railroad ballast ($0.83) was 5 cents more than for 1928. The figures for crushed stone include reports given by various railroads relative to the noncommercial material used by them, such information as was obtainable from highway departments of the different States on the amount of noncommercial crushed stone used for road construction, and information supplied by a large number of cities, towns, and counties that crushed stone for road and repair work. This class of information is difficult to obtain on account of the irregularity of operation and the incomplete records kept by the various municipalities.

Crushed stone sold or used by producers in the United States, 1928 and 1929, by kinds and uses

Kind	Concrete and road metal		Railroad ballast		Total		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average
1928							
Granite	5, 407, 310	$7, 057, 119	1, 532, 000	$1, 317, 914	6, 939, 310	$8, 375, 033	$1. 21
Basalt and related rocks (trap rock)	13, 114, 050	16, 473, 278	1, 682, 740	1, 902, 190	14, 796, 790	18, 375, 468	1. 24
Limestone	49, 075, 720	50, 490, 370	11, 876, 780	8, 803, 777	60, 952, 500	59, 294, 147	. 97
Sandstone	1, 905, 900	2, 301, 604	710, 760	544, 187	2, 616, 660	2, 845, 791	1. 09
Miscellaneous	4, 881, 510	4, 718, 978	1, 078, 590	576, 842	5, 960, 100	5, 295, 820	. 89
	74, 384, 490	81, 041, 349	16, 880, 870	13, 144, 910	91, 265, 360	94, 186, 259	
Average value per ton		1. 09		0. 78		1. 03	
1929							
Granite	4, 565, 450	5, 935, 978	1, 358, 200	1, 289, 669	5, 923, 650	7, 225, 647	1. 22
Basalt and related rocks (trap rock)	12, 507, 020	15, 610, 729	1, 822, 860	1, 954, 590	14, 329, 880	17, 565, 319	1. 23
Limestone	50, 090, 350	50, 057, 122	11, 374, 850	8, 877, 328	61, 465, 200	58, 934, 450	. 96
Sandstone	1, 949, 430	2, 202, 318	1, 222, 320	1, 096, 461	3, 171, 750	3, 298, 779	1. 04
Miscellaneous	7, 062, 520	6, 879, 346	768, 260	484, 337	7, 830, 780	7, 363, 683	. 94
	76, 174, 770	80, 685, 493	16, 546, 490	13, 702, 385	92, 721, 260	94, 387, 878	
Average value per ton		1. 06		0. 83		1. 02	

Crushed stone sold or used by producers in the United States, 1920–1929, by uses

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	32,823,900	$43,035,030	7,541,960	$7,811,663	40,365,860	$50,846,693
1921	36,765,790	45,338,984	6,437,050	6,378,494	43,202,840	51,717,478
1922	42,426,500	47,582,758	7,337,240	6,547,419	49,763,740	54,130,177
1923	51,047,900	58,356,094	11,274,810	9,572,557	62,322,710	67,928,651
1924	57,684,210	65,128,692	10,514,230	8,732,884	68,198,440	73,861,576
1925	62,823,800	69,986,729	12,849,130	10,521,700	75,672,930	80,508,429
1926	66,892,530	75,049,930	15,623,030	12,822,084	82,515,560	87,872,014
1927	78,544,210	84,177,237	16,404,560	13,297,030	94,948,770	97,474,267
1928	74,384,490	81,041,349	16,880,870	13,144,910	91,265,360	94,186,259
1929	76,174,770	80,685,493	16,546,490	13,702,385	92,721,260	94,387,878

Crushed stone sold or used by producers in the United States in 1929, by States and uses

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	92,710	$151,862	95,940	$54,663	188,650	$206,525
Arizona	[1] 255,350	[1] 285,471	-------	-------	[1] 255,350	[1] 285,471
Arkansas	[1] 303,030	[1] 402,527	[1] 3,940	[1] 4,143	491,840	676,467
California	7,319,320	6,460,561	996,290	773,216	8,315,610	7,233,777
Colorado	181,760	129,409	183,790	37,101	365,550	166,510
Connecticut	[1] 2,224,590	[1] 2,510,763	295,080	295,118	[1] 2,519,670	[1] 2,805,881
Delaware	(2)	(2)	-------	-------	(2)	(2)
Florida	1,728,530	1,260,293	284,560	267,654	2,013,090	1,527,947
Georgia	596,840	615,510	57,440	52,453	654,280	667,963
Hawaii	349,980	615,227	1,400	2,557	351,380	617,784
Idaho	204,020	221,700	17,800	3,565	221,820	225,265
Illinois	5,389,000	4,255,550	936,240	724,302	6,325,240	4,979,852
Indiana	3,033,890	2,748,016	467,490	415,096	3,501,380	3,163,112
Iowa	1,158,490	1,182,773	107,390	45,809	1,265,880	1,228,582
Kansas	805,530	848,369	520,490	460,329	1,326,020	1,308,698
Kentucky	1,414,860	1,586,340	825,670	606,508	2,240,530	2,192,848
Louisiana	(2)	(2)	(2)	(2)	(2)	(2)
Maine	64,870	133,764	-------	-------	64,870	133,764
Maryland	[1] 710,230	[1] 1,002,732	[1] 82,800	[1] 116,992	992,090	1,402,782
Massachusetts	[1] 2,402,610	[1] 3,249,882	363,980	369,642	[1] 2,766,590	[1] 3,619,524
Michigan	[1] 2,229,870	[1] 1,398,603	239,910	158,554	[1] 2,469,780	[1] 1,557,157
Minnesota	317,170	345,229	-------	-------	317,170	345,229
Mississippi	(2)	(2)	(2)	(2)	(2)	(2)
Missouri	[1] 2,280,940	[1] 2,875,012	214,040	193,952	[1] 2,494,980	[1] 3,068,964
Montana	32,720	32,391	2,630	735	35,350	33,126
Nebraska	76,060	80,677	(2)	(2)	[1] 76,060	[1] 80,677
New Hampshire	[1] 54,520	[1] 73,975	-------	-------	[1] 54,520	[1] 73,975
New Jersey	[1] 2,283,310	[1] 3,455,137	217,610	255,185	[1] 2,500,920	[1] 3,710,322
New Mexico	[1] 20,930	[1] 21,193	(2)	(2)	400,090	217,552
New York	10,148,050	13,489,699	887,770	783.049	11,035,820	14,272,748
North Carolina	[1] 1,275,930	[1] 1,651,623	114,150	114,448	[1] 1,390,080	[1] 1,766,071
Ohio	7,742,080	6,641,627	2,449,490	2,008,343	10,191,570	8,649,970
Oklahoma	[1] 1,467,550	[1] 1,228,128	552,760	270,548	[1] 2,020,310	[1] 1,498,676
Oregon	1,350,950	1,219,043	14,700	19,000	1,365,650	1,238.043
Pennsylvania	6,862.940	8,106,536	1,021,610	1,244,091	7,884,550	9,350,627
Porto Rico	36,110	49,133	70	129	36,180	49,262
Rhode Island	131,530	223,769	-------	-------	131,530	223,769
South Carolina	948,150	1,262,740	77,720	76,096	1,025,870	1,338,836
South Dakota	209,800	283,868	-------	-------	209,800	283,868
Tennessee	1,067,270	1,127,167	973,270	763,495	2,040,540	1,890,662
Texas	2,061,910	1,705,000	1,388,770	940,747	3,450,680	2,645,747
Vermont	[1] 66,740	[1] 99,106	1,360	1,558	[1] 68,100	[1] 100,664
Virginia	[1] 1,187,720	[1] 1,151,557	1,696,140	1,531,082	[1] 2,883,860	[1] 2,682,639
Washington	1,401,450	1,540,548	78,750	53,009	1,480,200	1,593,557
West Virginia	644,700	653,706	564,220	399,145	1,208,920	1,052,851
Wisconsin	[1] 3,235,260	[1] 3,253,852	[1] 62,980	[1] 51,003	3,438.890	3,406,577
Wyoming	(2)	(2)	(2)	(2)	(2)	(2)
Undistributed	805.500	1,055,425	748,240	609,068	650.000	813,557
	76,174,770	80,685,493	16,546,490	13,702,385	92,721,260	94,387,878

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[1] To avoid disclosing confidential information certain totals are somewhat incomplete, the figures not included being combined under "Undistributed."

[2] Included under "Undistributed."

LIME[1]

By A. T. Coons

SUMMARY

Sales of lime in 1929 by producers in the United States amounted to 4,269,768 short tons, valued at $33,478,848, a decrease of 4 per cent in quantity and 8 per cent in value compared with 1928. Conditions in the lime industry during 1929 were unsettled, with general decreases in price and considerable variations in demand. Lime for construction (1,640,827 tons, valued at $14,303,539) was affected most by the unsettled conditions and showed a decrease of 17 per cent in quantity and 19 per cent in value from 1928. Lime for chemical use (2,290,612 tons, valued at $16,787,408) increased 7 per cent in quantity and 2 per cent in value, and lime for agriculture (338,329 tons, valued at $2,387,901) increased 1 per cent in quantity and 4 per cent in value. Ohio and Pennsylvania, the largest producing States, showed decreases of 5 and 6 per cent, respectively, in quantity. Of the other States producing considerable quantities of lime Alabama, Illinois, Indiana, Missouri, New York, Texas, Vermont, and West Virginia increased in quantity, and California, Maine, Maryland, Massachusetts, Michigan, Tennessee, Virginia, and Wisconsin decreased.

The total number of plants that reported operations in 1929 was 381, 30 less than in 1928. Pennsylvania showed a noticeable decrease in the number of intermittently operated small field kilns. Only seven States showed a larger number of operating plants than in 1928, and such increases were limited to one plant in a State except in Arizona. Labor conditions and wages at the plants were about the same as in 1928, the cost of materials was somewhat lower, and prices also were lower. The average value per ton at the plant of the total lime sold decreased from $8.18 in 1928 to $7.84 in 1929. The average value per ton for building lime ($8.72) was 19 cents less than in 1928, for chemical lime ($7.33) was 37 cents less, and for agricultural lime ($7.06) was 21 cents more. Except for the output of one firm in Alabama the accompanying tables do not include lime that is not a commercial product but is burned, for use in manufacturing, from stone either quarried or purchased by the manufacturer. This stone is reported to the Bureau of Mines as raw limestone and is included in the statistics on stone; it is used mainly by alkali works, carbide works, sugar refineries, paper mills, and smelters and other metallurgical plants.

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[1] Work on manuscript completed September, 1930.

PRODUCTION

Lime sold by producers in the United States, 1920–1929

Year	Number of plants in operation	Short tons	Value [1]	
			Total	Average
1920	515	3, 570, 141	$37, 543, 840	$10. 52
1921	520	2, 532, 153	24, 895, 370	9. 83
1922	530	3, 639, 617	33, 255, 039	9. 14
1923	467	4, 076, 243	39, 993, 652	9. 81
1924	450	4, 072, 000	39, 596, 423	9. 72
1925	450	4, 580, 823	42, 609, 141	9. 30
1926	435	4, 560, 398	41, 566, 452	9. 11
1927	417	4, 414, 932	38, 638, 413	8. 75
1928	411	4, 458, 412	36, 449, 635	8. 18
1929	381	4, 269, 768	33, 478, 848	7. 84

[1] The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Lime sold by producers in the United States, 1928 and 1929, by States

State	1928			1929		
	Number of plants in operation	Short tons	Value	Number of plants in operation	Short tons	Value
Alabama	11	192, 364	$1, 407, 232	10	209, 260	$1, 223, 623
Arizona	2	36, 244	343, 167	4	42, 971	397, 308
Arkansas	5	40, 438	339, 624	4	33, 647	295, 816
California	9	60, 751	617, 472	9	49, 753	526, 391
Colorado	3	8, 114	88, 775	4	7, 046	76, 791
Connecticut	6	48, 152	529, 936	4	35, 180	386, 855
Florida	3	4, 748	50, 086	2	(1)	(1)
Georgia	1	12, 890	83, 045	1	10, 757	77, 239
Hawaii	1	6, 284	72, 092	1	6, 384	77, 389
Idaho	1	(1)	(1)	1	(1)	(1)
Illinois	8	115, 523	1, 017, 001	8	119, 382	973, 312
Indiana	8	107, 209	734, 915	8	116, 795	786, 814
Iowa	2	(1)	(1)	1	(1)	(1)
Kentucky	2	(1)	(1)	1	(1)	(1)
Maine	4	123, 023	1, 056, 443	4	92, 428	772, 443
Maryland	11	59, 508	440, 886	12	54, 029	404, 674
Massachusetts	8	171, 944	2, 026, 019	7	133, 644	1, 443, 984
Michigan	8	104, 917	962, 708	6	91, 468	844, 543
Minnesota	3	(1)	(1)	3	(1)	(1)
Missouri	14	303, 014	2, 252, 420	13	316, 579	2, 319, 886
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	1	(1)	(1)	1	(1)	(1)
New Jersey	2	(1)	(1)	1	1, 644	15, 618
New Mexico	2	2, 002	19, 665	2	(1)	(1)
New York	13	93, 354	794, 301	12	104, 614	906, 021
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	28	1, 013, 676	8, 919, 596	27	962, 415	7, 935, 656
Oklahoma	--------	--------	--------	1	(1)	(1)
Oregon	3	2, 090	34, 372	3	2, 486	40, 406
Pennsylvania	130	834, 050	6, 119, 036	116	782, 915	5, 896, 752
Porto Rico	15	9, 405	147, 040	12	10, 114	131, 887
Rhode Island	1	2, 589	36, 875	1	1, 885	24, 464
South Dakota	2	(1)	(1)	2	(1)	(1)
Tennessee	9	183, 541	1, 238, 945	10	172, 936	1, 036, 405
Texas	5	82, 325	751, 729	6	97, 332	838, 470
Utah	11	47, 662	385, 476	10	46, 581	365, 055
Vermont	8	52, 445	485, 235	7	53, 128	505, 246
Virginia	32	171, 067	1, 208, 618	29	153, 170	1, 061, 018
Washington	4	24, 529	265, 922	4	31, 598	324, 683
West Virginia	12	279, 947	1, 788, 989	13	308, 600	1, 865, 531
Wisconsin	20	163, 965	1, 374, 749	18	130, 902	1, 094, 388
Undistributed	--------	97, 642	857, 266	--------	90, 125	830, 180
	411	4, 458, 412	36, 449, 635	381	4, 269, 768	33, 478, 848

[1] Included under "Undistributed."

Lime sold by producers in the United States, 1928 and 1929, by uses

Use	Quantity		Value	
	Percentage of total	Short tons	Total	Average
1928				
Agricultural	7.5	333,910	$2,287,558	$6.85
Building	44.6	1,986,465	17,706,420	8.91
Chemical:				
Glass works	1.7	76,161	588,305	7.72
Metallurgy	11.3	504,248	3,055,081	6.06
Paper mills	9.6	429,334	3,260,733	7.59
Refractory lime (dead-burned dolomite)	10.1	448,761	4,283,036	9.54
Sugar refineries	.5	22,678	280,186	12.35
Tanneries	1.4	64,464	494,983	7.68
Other uses [1]	13.3	592,391	4,493,333	7.59
Total chemical	47.9	2,138,037	16,455,657	7.70
	100.0	4,458,412	36,449,635	8.18
Hydrated lime (included in above totals)	36.2	1,612,818	13,540,215	8.40
1929				
Agricultural	7.9	338,329	2,387,901	7.06
Building	38.4	1,640,827	14,303,539	8.72
Chemical:				
Glass works	1.8	75,283	544,760	7.24
Metallurgy	13.6	578,488	3,258,992	5.63
Paper mills	9.6	411,017	3,057,350	7.44
Refractory lime (dead-burned dolomite)	11.4	488,032	4,261,942	8.73
Sugar refineries	.5	20,758	249,190	12.00
Tanneries	1.6	67,046	516,207	7.70
Other uses [1]	15.2	649,988	4,898,967	7.54
Total chemical	53.7	2,290,612	16,787,408	7.33
	100.0	4,269,768	33,478,848	7.84
Hydrated lime (included in above totals)	36.3	1,550,771	12,771,525	8.24

[1] Details of distribution shown in following table.

It is necessary to classify much material as "unspecified," because many of the manufacturers do not report the uses of that part of their lime which they sell for chemical purposes. This lime is known to be applied to several of the uses enumerated, but the following figures are the best available.

Chemical lime sold by producers in the United States for "other uses," 1928 and 1929

Use	1928		1929	
	Short tons	Value	Short tons	Value
Alcohol manufacture and dehydration	2,302	$14,610	308	$3,705
Alkali works (ammonia, soda, potash)	6,675	54,962	21,167	133,901
Bleaching powder	14,970	116,235	7,852	59,919
Bleach, liquid	18,954	166,319	18,047	155,384
Calcium acetate	1,643	9,460	21,284	155,783
Calcium carbide	32,596	194,334	30,999	183,388
Coke and gas manufacture (gas purification and plant by-products)	31,011	214,244	34,227	240,314
Glue	8,467	65,289	9,887	75,414
Insecticides (spraying materials)	19,269	163,005	26,890	228,713
Oil and fat manufacture	9,119	81,595	20,985	171,897
Paint (kalsomine, whitewash, varnish, etc.)	5,017	47,947	5,111	55,889
Rubber	3,361	33,863	4,789	40,501
Salt refining	2,423	18,167	2,184	16,201
Sand-lime and slag brick	47,527	380,650	42,540	312,427
Sanitation (sewage and garbage purification, etc.)	2,857	18,389	4,537	30,428
Silica brick	15,735	120,523	18,391	139,856
Soap	33,759	181,530	30,575	171,753
Textiles	1,460	14,101	2,851	29,386
Water purification	145,757	1,158,865	156,117	1,206,603
Wood distillation	3,899	28,496	4,445	34,293
Undistributed [1]	53,198	436,124	40,991	367,303
Unspecified	132,392	974,625	145,811	1,085,909
	592,391	4,493,333	649,988	4,898,967

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[1] Lime used in acid neutralization and drying, acetic acid, asphalt and fertilizer filler, bichromate refining, buffing compounds, calcium phosphate, cellulose, corn products, creameries and dairies, cyanide manufacture, disinfectants (chloride of lime, etc.), dyes, flotation, flour mills, food products, gelatin (edible), magnesia, medicine, nitrogen manufacture, oil refining, oxygen purification, retarder, and stock food.

Lime sold by producers in the United States in 1929, by States and uses

State	Building		Agricultural		Chemical												Total	
					Glass works		Paper mills		Sugar refineries		Tanneries		Metallurgy		Other chemical			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	64,259	$471,390			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	45,820	$222,748	209,260	$1,223,623
Arizona	14,799	185,231	(1)	(1)							67	$797	23,733	$144,715	(1)	(1)	42,971	397,308
Arkansas	15,231	166,932					(1)	(1)							(1)	(1)	33,647	295,816
California	30,572	330,833	2,502	$15,129			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	49,753	526,391
Colorado	2,850	28,886	4	60									2,388	26,931	1,804	20,914	7,046	76,791
Connecticut	30,351	347,745	(1)	(1)			(1)	(1)			(1)	(1)					35,180	386,855
Florida	(1)	(1)															(1)	(1)
Georgia	10,430	75,748	327	1,491													10,757	77,239
Hawaii	334	5,535	712	2,460					5,338	$69,394							6,384	77,389
Idaho	(1)	(1)	(1)	(1)			(1)	(1)									(1)	(1)
Illinois	51,476	451,709					9,210	$65,607			6,887	56,638	5,782	39,864	46,027	359,494	119,382	973,312
Indiana	18,418	121,075	6,328	28,559	4,834	$34,649	23,970	153,028			1,949	13,843	15,161	92,614	46,135	343,046	116,795	786,814
Iowa	(1)	(1)															(1)	(1)
Kentucky	(1)	(1)	(1)	(1)							(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maine	35,005	325,405	13,405	62,365			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	92,428	772,443
Maryland	(1)	(1)	47,628	369,129											(1)	(1)	54,029	404,674
Massachusetts	87,156	1,087,310	4,364	21,165			16,646	128,041	(1)	(1)	(1)	(1)	(1)	(1)	21,704	169,163	133,644	1,443,984
Michigan	4,536	40,347					51,941	504,779			1,545	14,045			33,446	285,372	91,468	844,543
Minnesota	(1)	(1)					(1)	(1)					(1)	(1)	(1)	(1)	(1)	(1)
Missouri	91,945	806,958	4,656	27,538	(1)	(1)	14,052	94,348	(1)	(1)	2,542	19,667	47,207	270,561	155,002	1,091,782	316,579	2,319,886
Montana	(1)	(1)											(1)	(1)	(1)	(1)	(1)	(1)
Nevada	(1)	(1)			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)	(1)	(1)
New Jersey	1,644	15,618															1,644	15,618
New Mexico	(1)	(1)													(1)	(1)	(1)	(1)
New York	29,877	208,719	4,505	34,373	(1)	(1)	16,054	143,143	(1)	(1)	(1)	(1)	22,990	209,750	27,169	266,074	104,614	906,021
North Carolina	(1)	(1)									(1)	(1)					(1)	(1)
Ohio	589,478	4,729,016	34,338	203,623	63,525	451,811	30,818	213,390					19,113	136,177	225,143	2,201,639	962,415	7,935,656
Oklahoma													(1)	(1)	(1)	(1)	(1)	(1)
Oregon	1,786	34,906	(1)	(1)											(1)	(1)	2,486	40,406
Pennsylvania	170,926	1,453,556	160,856	1,257,687	(1)	(1)	43,216	313,271	(1)	(1)	22,649	167,850	149,980	833,657	231,481	1,842,066	782,915	5,896,752
Porto Rico	118	814	2,549	15,172					7,235	112,278					212	3,623	10,114	131,887
Rhode Island	1,024	16,333	806	7,254											55	877	1,885	24,464
South Dakota	(1)	(1)											(1)	(1)	(1)	(1)	(1)	(1)
Tennessee	49,581	431,246	393	2,202			57,159	281,524	2,154	14,025	3,689	21,642	23,162	104,302	36,798	181,464	172,936	1,036,405
Texas	55,491	499,191			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	19,788	185,806	97,332	838,470
Utah	8,265	118,790	(1)	(1)									36,308	219,119	(1)	(1)	46,581	365,055
Vermont	27,980	301,345	3,508	12,402			7,684	65,487			2,688	28,633	3,478	30,709	7,790	66,670	53,128	505,246
Virginia	49,381	378,382	31,408	208,152			17,988	113,923	642	4,353	10,593	65,921	4,331	46,655	38,827	243,632	153,170	1,061,018
Washington	12,926	141,465	(1)	(1)			12,013	117,208	(1)	(1)			(1)	(1)	(1)	(1)	31,598	324,683
West Virginia	(1)	(1)	15,527	90,192	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	160,678	1,192,953	308,600	1,865,531
Wisconsin	118,005	930,519	(1)	(1)			(1)	(1)			(1)	(1)			2,924	84,081	130,902	1,094,388
Undistributed	66,983	598,535	4,513	28,948	6,924	58,300	110,266	863,601	5,389	49,140	14,437	127,171	224,855	1,103,938	37,217	399,505	90,125	830,180
	1,640,827	14,303,539	338,329	2,387,901	75,283	544,760	411,017	3,057,350	20,758	249,190	67,046	516,207	578,488	3,258,992	1,138,020	9,160,909	4,269,768	33,478,848

[1] Included under "Undistributed."

BUILDING LIME

Sales of lime for construction amounted to 1,640,827 short tons, valued at $14,303,539, in 1929, a decrease of 17 per cent in quantity and 19 per cent in value from 1928. Lime of this class apparently was more affected by building-trade conditions, competition, overproduction, and price lowering than chemical or agricultural lime, as sales of both of these classes of lime increased. Eight States—Alabama, Arizona, Arkansas, Indiana, New Jersey, New York, Texas, and Vermont—showed an increased output of building lime. Ohio, Pennsylvania, Wisconsin, Missouri, and Massachusetts were the largest producers of lime for building, but sales for this purpose from these States in 1929 decreased 10, 32, 23, 2, and 31 per cent, respectively, from those in 1928. Ohio produced 36 per cent of the building lime sold by producers in the United States in 1929; 98 per cent of this output was hydrated lime, the greater part of which was sold as high-grade finishing lime. The sales from Ohio, classified according to kinds of lime, are given in the following table:

Lime sold by Ohio producers for construction, 1927–1929

	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Quicklime	21,750	$160,168	15,721	$99,363	12,676	$83,102
Hydrated lime	671,294	6,607,660	642,144	5,513,124	576,802	4,645,914
	693,044	6,767,828	657,865	5,612,487	589,478	4,729,016

Of the total hydrated lime sold by producers in the United States in 1929, Ohio produced 615,072 tons (9 per cent less than in 1928), or 39.7 per cent. Of this total, 576,802 tons (94 per cent) was sold for construction and was widely distributed throughout continental United States. Figures of distribution of hydrated lime, as reported to the Bureau of Mines, presented for blocks of contiguous States roughly comprising various freight-rate zones are given in the following table. Possibly some of the lime reported as supplied to the various districts is reshipped by dealers.

Shipments of hydrated lime from plants in the United States and in Ohio, 1928 and 1929, by destinations

Destination	From all plants		From Ohio plants		
	Short tons	Distribution (per cent)	Short tons	Distribution (per cent)	Group total (per cent)
1928					
Illinois, Indiana, Michigan, Ohio	417,086	25.9	306,733	45.5	73.5
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	647,443	40.1	249,683	37.0	38.6
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	77,749	4.8	25,582	3.8	32.9
Florida, Georgia, North Carolina, South Carolina, Virginia	145,884	9.1	35,083	5.2	24.0
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	92,607	5.7	19,983	3.0	21.6
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	165,016	10.2	30,708	4.5	18.6
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	54,085	3.4	2,961	.4	5.5
Undistributed and exports	12,948	.8	3,911	.6	30.2
	1,612,818	100.0	674,644	100.0	41.8
1929					
Illinois, Indiana, Michigan, Ohio	389,273	25.1	274,269	44.6	70.5
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	630,038	40.6	224,123	36.4	35.6
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	78,394	5.1	25,019	4.1	31.9
Florida, Georgia, North Carolina, South Carolina, Virginia	121,095	7.8	31,163	5.1	25.7
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	75,673	4.9	18,314	3.0	24.2
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	179,948	11.6	31,663	5.1	17.6
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	60,753	3.9	2,998	.5	5.0
Undistributed and exports	15,597	1.0	7,523	1.2	48.2
	1,550,771	100.0	615,072	100.0	39.7

CHEMICAL LIME

Sales of lime for chemical use amounted to 2,290,612 short tons, valued at $16,787,408, in 1929, an increase of 7 per cent in quantity and 2 per cent in value over 1928. The demand for chemical lime in 1929 was better than that for any other class. Pennsylvania, Ohio, West Virginia, and Missouri are the largest producers of chemical lime. The quantity and value of lime used in the various chemical industries, so far as reported to the Bureau of Mines, are given in the tables on pages 269 to 271.

AGRICULTURAL LIME AND OTHER LIMING MATERIALS

An increase of 1 per cent in quantity and 4 per cent in value over 1928 marked the output of lime for agriculture in 1929, and sales amounted to 338,329 short tons, valued at $2,387,901, of which more than one-fourth (89,654 tons) was quicklime and nearly three-fourths (248,675 tons) hydrated lime. Pennsylvania, Maryland, Ohio, and Virginia are the largest producers. The production of agricultural lime, as well as the output of pulverized limestone for agricultural purposes, has in general increased since 1924. The output of agricultural limestone in 1929—2,654,580 short tons, valued at $3,764,775—represented an increase of 21 per cent in quantity and 19 per cent in value over 1928. The quantity of lime reported as burned from oyster shells and used for liming land decreased; sales of calcareous marl (38,990 short tons, valued at $130,866), of which all but a negligible quantity sold as a filler was used for agriculture, also decreased. The table following gives available data on the quantity and value of different kinds of liming materials sold by producers in 1928 and 1929. The method by which the effective lime content of the different forms of land lime is calculated was explained in Mineral Resources for 1921.

Agricultural lime and other liming materials sold by producers in the United States, 1928 and 1929, by kinds

Kind	Short tons		Value	
	Gross	Effective lime content	Total	Average
1928				
Lime from limestone:				
Quicklime	110,533	93,000	$639,615	$5.79
Hydrated	223,377	156,000	1,647,943	7.38
Lime from oyster shells [1]	15,371	13,000	126,844	8.25
Limestone (pulverized)	2,186,870	940,000	3,153,848	1.44
Calcareous marl	61,034	26,000	200,704	3.29
1929				
Lime from limestone:				
Quicklime	89,654	75,400	448,634	5.00
Hydrated	248,675	165,000	1,939,267	7.80
Lime from oyster shells [2]	14,000	11,800	119,000	8.50
Limestone (pulverized)	2,654,580	1,141,000	3,764,775	1.42
Calcareous marl	38,990	16,600	130,866	3.36

[1] Department of Commerce, Bureau of Fisheries, Statistical Bull. 821, p. 7.

[2] Partly estimated.

The figures in the preceding table do not include calcareous marl used for the manufacture of cement; they represent the output of fresh-water marl, chiefly for agriculture. The chief producing States in order of output in 1929 were California, West Virginia, and Virginia. The other States producing in 1929 were Illinois, Maine, Montana, North Carolina, Ohio, South Carolina, and Utah.

HYDRATED LIME

Statistics of the output of hydrated lime include only the product made in hydrating machines; they exclude hand-slaked lime. Hydrated lime has shown a general increase in production since the figures of output (120,357 short tons) were first reported for 1906. Since 1906 there have been but seven years (1908, 1911, 1917, 1918, 1921, 1927, and 1929) in which the production has been below that of the preceding year. The output in 1929—1,550,771 short tons, valued at $12,771,525—represents a decrease of 4 per cent in quantity and 6 per cent in value from 1928. Seven firms less reported the hydrated product in 1929 than in 1928. The greater part of the hydrated lime is sold for construction; 64 per cent of the total was sold in 1929 for construction, 20 per cent for the manufacture of chemicals, and 16 per cent for agriculture. Sales of hydrated lime for agricultural and chemical use increased in 1929, but those for construction decreased.

Hydrated lime sold by producers in the United States, 1920–1929

Year	Number of plants in operation	Short tons	Value	
			Total	Average
1920	98	853,116	$9,287,562	$10.89
1921	105	792,970	7,421,637	9.36
1922	114	1,106,063	9,868,980	8.92
1923	121	1,225,928	12,229,598	9.98
1924	120	1,316,664	13,199,846	10.03
1925	134	1,560,848	15,287,461	9.79
1926	147	1,606,811	15,182,460	9.45
1927	157	1,596,906	14,581,695	9.13
1928	164	1,612,818	13,540,215	8.40
1929	157	1,550,771	12,771,525	8.24

Hydrated lime sold by producers in the United States, 1928 and 1929, by States

State	1928		1929	
	Short tons	Value	Short tons	Value
Alabama	34,376	$269,727	40,688	$308,978
California	14,245	165,481	12,305	152,131
Florida	3,680	34,229	(1)	(1)
Georgia	12,593	81,256	10,308	74,814
Hawaii	6,187	70,928	6,350	76,879
Illinois	31,214	262,869	33,659	274,001
Indiana	41,664	333,355	50,004	363,775
Maryland	29,091	247,540	35,869	286,972
Massachusetts	18,920	146,525	16,731	128,547
Michigan	18,135	212,748	17,527	205,786
Missouri	100,217	853,577	107,759	918,796
New York	35,084	260,690	46,665	346,879
Ohio	674,644	5,723,712	615,072	4,886,355
Pennsylvania	273,973	2,185,386	259,251	2,232,117
Rhode Island	669	6,021	806	7,254
Tennessee	69,721	580,348	41,021	318,968
Texas	35,133	344,444	40,149	382,199
Vermont	11,291	88,449	10,423	84,825
Virginia	69,988	488,602	53,330	381,488
West Virginia	40,464	273,944	51,426	346,105
Wisconsin	11,560	119,416	11,668	103,005
Undistributed [2]	79,969	790,968	89,760	891,651
	1,612,818	13,540,215	1,550,771	12,771,525

[1] Included under "Undistributed."

[2] 1928: Arizona, Arkansas, Colorado, Connecticut, Kentucky, Maine, Minnesota, Montana, Nevada, New Jersey, North Carolina, Oregon, Utah, and Washington; 1929: Arizona, Arkansas, Colorado, Connecticut, Florida, Kentucky, Maine, Minnesota, Montana, Nevada, New Jersey, North Carolina, Oregon, Porto Rico, South Dakota, Utah, and Washington.

Hydrated lime sold by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Short tons	Value	Short tons	Value
Agricultural	223,377	$1,647,943	248,675	$1,939,267
Building	1,108,112	9,406,621	989,687	8,150,887
Chemical:				
Glass works	4,589	42,707	4,871	45,698
Metallurgy	17,336	165,626	18,638	162,801
Paper mills	31,752	317,054	24,728	210,783
Sugar refineries	10,605	113,413	10,812	113,291
Tanneries	23,152	186,551	24,880	195,922
Other uses	193,895	1,660,300	228,480	1,952,876
Total chemical	281,329	2,485,651	312,409	2,681,371
	1,612,818	**13,540,215**	**1,550,771**	**12,771,525**

EXPORTS AND IMPORTS [2]

Lime exported from the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	5, 921	$128, 296	1925	14, 800	$218, 696
1921	5, 192	109, 769	1926	12, 960	191, 768
1922	8, 289	116, 649	1927	15, 478	210, 977
1923	11, 789	170, 289	1928	18, 188	245, 004
1924	14, 905	212, 340	1929	17, 334	239, 440

Lime exported from the United States, 1928 and 1929, by countries

Country	1928		1929	
	Short tons	Value	Short tons	Value
North America:				
Canada	8, 983	$104, 404	9, 176	$105, 923
Central America—				
British Honduras	2	24	(a)	4
Costa Rica	------	------	5	127
Guatemala	16	322	11	263
Honduras	450	6, 144	298	4, 642
Nicaragua	232	5, 505	94	2, 447
Panama	213	4, 699	101	2, 423
Salvador	36	727	57	1, 145
Mexico	2, 730	26, 210	2, 708	30, 155
Newfoundland and Labrador	1	23	91	1, 620
West Indies—				
British—				
Jamaica	148	2, 737	246	5, 054
Other British	101	2, 210	128	2, 903
Cuba	353	5, 707	172	3, 297
Dominican Republic	1, 138	10, 449	1, 184	12, 145
Netherland	76	2, 097	107	3, 679
Virgin Islands of the United States	66	2, 113	33	1, 074
South America:				
Argentina	1	76	3	173
Bolivia	30	600	------	------
Brazil	7	252	6	241
Chile	197	3, 118	1, 126	15, 944
Colombia	289	5, 969	125	2, 568
Ecuador	2	45	20	496
Guiana—Surinam (Netherland)	5	100	------	------
Peru	666	14, 361	803	16, 607
Uruguay	(a)	20	------	------
Venezuela	15	571	84	2, 185
Europe:				
France	------	------	21	843
Sweden	34	1, 575	52	2, 222
United Kingdom	2	100	9	289
Asia:				
China	1	25	3	86
Japan	632	6, 126	201	9, 934
Philippine Islands	1, 728	33, 300	438	9, 611
Africa:				
British—				
South, Union of	19	5, 000	------	------
West ("Other")	------	------	3	116
Liberia	6	168	9	310
Oceania:				
Australia	6	175	13	772
French Oceania	3	52	7	136
Other	------	------	(a)	6
	18, 188	245, 004	17, 334	239, 440

[a] Less than 1 ton.

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[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Lime imported for consumption in the United States, 1920–1929 [1]

Year	Short tons	Value	Year	Short tons	Value
1920	22,688	$392,137	1925	15,323	$285,599
1921	10,811	234,798	1926	18,702	346,969
1922	14,112	290,845	1927	19,567	356,836
1923	25,407	428,903	1928	18,321	344,296
1924	20,480	377,994	1929	21,501	390,736

[1] Most of the lime imported into the United States comes from Canada.

SHIPMENTS

Shipments of lime, as reported to the Bureau of Mines by the producers, have been combined in the tables following to show for the year 1929 the movement of this product according to its origin (sales), shipments into State, shipments from State, and probable consumption or supply of lime in each State, and according to its origin in and destination in State groups which approximately comprise various freight-rate zones. The figures in the second of these tables do not cover an inconsiderable quantity of lime (less than 1 per cent of the total) comprising the production in Hawaii and Porto Rico, the shipments abroad, and the product for which distribution is not recorded. No account is taken of reshipments.

Lime supplies available for consumption in continental United States in 1929, by States, in short tons

State	Sales by producers	Shipments from State	Shipments into State	Supply			
				Hydrated lime	Quicklime	Total	Pounds per capita [1]
Alabama	209,260	58,963	8,342	22,037	136,602	158,639	120
Arizona	42,971	13,988	41	1,284	27,740	29,024	133
Arkansas	33,647	22,757	3,488	4,472	9,906	14,378	16
California	49,753	4,231	43,140	26,394	62,268	88,662	31
Colorado	7,046	754	13,966	7,483	12,775	20,258	39
Connecticut	35,180	22,644	26,599	13,369	25,766	39,135	49
Delaware	-----	-----	47,105	16,797	30,308	47,105	395
District of Columbia	-----	-----	17,899	14,769	3,130	17,899	74
Florida	(2)	-----	(2)	17,749	8,794	26,543	36
Georgia	10,757	3,230	27,494	26,389	8,632	35,021	24
Idaho	(2)	(2)	2,744	1,622	1,159	2,781	12
Illinois	119,382	50,159	254,173	110,762	212,634	323,396	85
Indiana	116,795	75,740	63,297	49,122	55,230	104,352	65
Iowa	(2)	-----	(2)	13,364	39,442	52,806	43
Kansas	-----	-----	34,818	18,517	16,301	34,818	37
Kentucky	(2)	(2)	63,895	12,432	55,436	67,868	52
Louisiana	-----	-----	65,883	12,658	53,225	65,883	62
Maine	92,428	40,689	25,014	11,199	65,554	76,753	192
Maryland	54,029	26,438	73,924	51,164	50,351	101,515	125
Massachusetts	133,644	104,296	72,216	38,155	63,409	101,564	48
Michigan	91,468	46,569	133,758	85,328	93,329	178,657	74
Minnesota	(2)	(2)	14,729	12,966	15,384	28,350	22
Mississippi	-----	-----	24,685	10,019	14,666	24,685	25
Missouri	316,579	233,827	14,658	33,625	63,785	97,410	54
Montana	(2)	(2)	1,384	2,536	12,539	15,075	56
Nebraska	-----	-----	11,927	7,138	4,789	11,927	17
Nevada	(2)	(2)	1,206	606	1,200	1,806	40
New Hampshire	-----	-----	14,873	3,351	11,522	14,873	64
New Jersey	1,644	-----	163,105	103,321	61,428	164,749	82
New Mexico	(2)	(2)	15,417	1,959	14,218	16,177	76
New York	104,614	43,316	368,482	208,554	221,226	429,780	68
North Carolina	(2)	(2)	71,530	36,299	39,131	75,430	48
North Dakota	-----	-----	6,897	5,388	1,509	6,897	20

[1] Based on Bureau of the Census preliminary statement for 1930; no estimate for 1929.
[2] Included under "Undistributed."

Lime supplies available for consumption in continental United States in 1929, by States, in short tons—Continued

State	Sales by producers	Shipments from State	Shipments into State	Supply			
				Hydrated lime	Quicklime	Total	Pounds per capita[1]
Ohio	962, 415	659, 496	95, 104	144, 061	253, 962	398, 023	120
Oklahoma	(2)	------------	(2)	16, 317	10, 679	26, 996	23
Oregon	2, 486	926	7, 311	2, 867	6, 004	8, 871	19
Pennsylvania	782, 915	281, 602	298, 019	219, 623	579, 709	799, 332	166
Rhode Island	1, 885	306	17, 644	9, 434	9, 789	19, 223	56
South Carolina	------------	------------	16, 908	10, 046	6, 862	16, 908	20
South Dakota	(2)	------------	(2)	2, 441	3, 013	5, 454	16
Tennessee	172, 936	135, 100	9, 925	18, 527	29, 234	47, 761	37
Texas	97, 332	28, 316	4, 932	40, 808	33, 140	73, 948	25
Utah	46, 581	2, 829	344	4, 143	39, 953	44, 096	175
Vermont	53, 128	49, 525	1, 516	2, 886	2, 233	5, 119	29
Virginia	153, 170	104, 455	40, 833	30, 612	58, 936	89, 548	74
Washington	31, 598	7, 745	4, 757	2, 681	25, 929	28, 610	37
West Virginia	308, 600	276, 198	37, 635	15, 810	54, 227	70, 037	81
Wisconsin	130, 902	86, 391	79, 631	32, 741	91, 401	124, 142	85
Wyoming	------------	------------	1, 781	1, 349	432	1, 781	16
Undistributed	90, 125	45, 464	103, 720	------------	------------	------------	--------
	4, 253, 270	[3] 2, 425, 954	2, 406, 749	1, 535, 174	2, 698, 891	4, 234, 065	69

[1] Based on Bureau of the Census preliminary statement for 1930; no estimate for 1929.
[2] Included under "Undistributed."
[3] Includes 19,205 tons of lime exported or unspecified by producers as to destination.

Lime shipped in continental United States in 1929, by origin and destination of shipments, in short tons

Destination	Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Rhode Island, Vermont			Florida, Georgia, North Carolina, Virginia		
	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total
Illinois, Indiana, Michigan, Ohio	346,504	396,857	743,361	8,940	53,965	62,905		7	7	640	498	1,138
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	225,458	77,349	302,807	370,805	760,419	1,131,224	17,453	110,454	127,907	15,205	51,484	66,689
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	25,019	32	25,051	9,374	29,662	39,036	42,090	145,899	187,989	410	2,513	2,923
Florida, Georgia, North Carolina, South Carolina, Virginia	31,165	5,173	36,338	4,552	7,019	11,571		10	10	52,345	50,255	102,600
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	20,502	30,867	51,369		500	500				80		80
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin	54,716	61,593	116,309	2	1,072	1,074					3	3
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	5,375	357	5,732	165	300	465						

Destination	Alabama, Kentucky, Tennessee			Arkansas, Iowa, Minnesota, Missouri, Oklahoma, Texas, Wisconsin			Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington			United States		
	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total	Hydrated lime	Quick-lime	Total
Illinois, Indiana, Michigan, Ohio	400	14,606	15,006	32,789	149,222	182,011				389,273	615,155	1,004,428
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia				1,117	673	1,790				630,038	1,000,379	1,630,417
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont				1,501	167	1,668				78,394	178,273	256,667
Florida, Georgia, North Carolina, South Carolina, Virginia	33,013	58,594	91,607	20	1,304	1,324				121,095	122,355	243,450
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	49,604	230,149	279,753	5,487	27,647	33,134				75,673	289,163	364,836
Arkansas, Iowa, Kansas, Minnesota, Missouri, Nebraska, Oklahoma, Texas, Wisconsin		181	181	124,970	221,738	346,708	260	240	500	179.948	284,827	464,775
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming				10,096	25,675	35,771	45,117	182,407	227,524	60,753	208,739	269.492

PRODUCING LOCALITIES

The Bureau of Mines has received many requests for general information concerning location of plants manufacturing lime of various grades and for various uses. To supply this information a list of the lime-manufacturing plants that report their annual sales of lime to the bureau has been prepared.

ALABAMA

Blount County: Allgood—Cheney Lime Co. (address, Protective Life Building, Birmingham) (Graystone Works); high-calcium; 6 shaft kilns; 120 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, mason's; Carson hydrator; open quarry.

Colbert County: Cherokee (Margerum)—Muscle Shoals White Lime Co. (Inc.) (address, Sheffield); high-calcium; 1 shaft kiln; 20 tons a day; bituminous coal; quicklime (lump), construction, chemical.

Jefferson County: Ensley—Tennessee Coal, Iron & Railroad Co. (address, Birmingham); high-magnesium; 9 rotary kilns; manufacture of steel; dead-burned dolomite; open quarry.

Shelby County:
- Calera—Alabama Lime & Stone Corporation; high-calcium; 2 pot kilns, 2 gas kilns; 40 tons a day; bituminous coal; quicklime (lump, pebble), construction, agriculture; hydrated, construction; Schaffer hydrator; open quarry.
- Keystone—Keystone Lime Works; high-calcium; 8 shaft kilns; 80 tons a day; bituminous coal and wood; quicklime (lump, pebble), construction, chemical; hydrated, mason's, chemical; Clyde hydrator; open quarry.
- Newala—Newala Lime Works; high-calcium; 2 shaft kilns; 40 tons a day; wood and bituminous coal; quicklime (lump), construction; hydrated, mason's; Clyde hydrator; open quarry.
- Pelham—Superior Lime & Hydrate Co.; high-calcium; 6 shaft kilns; 60 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's; Clyde hydrator; open quarry.
- Roberta—Calera Lime Works (address, Calera); high-calcium; 3 vertical kilns; 40 tons a day; bituminous coal and wood; quicklime (lump), construction; hydrated, construction; open quarry.
- Saginaw—
  - Cheney Lime Co. (address, Protective Life Building, Birmingham) (Shelby Works); high-calcium; 6 vertical or shaft kilns; 75 tons a day; coal and wood; quicklime (lump), construction, chemical; open quarry.
  - Saginaw Lime & Stone Co. (address, Longview); high-calcium; 8 shaft kilns; 120 tons a day; bituminous coal and wood; quicklime (lump), construction; hydrated, mason's; Clyde hydrator; open quarry.

ARIZONA

Cochise County: Forrest—Paul Lime Plant (address, Douglas); high-calcium, low-magnesium; 7 vertical kilns; 90 tons a day; anthracite, oil; quicklime (lump), construction, chemical; hydrated, construction; Schulthess hydrator; open quarry.

Gila County: Globe—New Process Lime Co. (Inc.); 1 vertical kiln; anthracite; quicklime (lump), chemical. Operations started June, 1929.

Yavapai County:
- Nelson—Grand Canyon Lime & Cement Co. (address, Los Angeles, Calif.); high-calcium; 6 shaft kilns; 120 tons a day; oil; hydrating plant at Los Angeles, Calif.; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.
- Puntenney—Paul, Sheffield & Paul (lessees, Puntenney Lime Co.); high-calcium; 4 shaft kilns; 50 to 60 tons a day; wood; quicklime (lump, crushed), construction, chemical.

ARKANSAS

Independence County: Limedale—Batesville White Lime Co. (address, Batesville); high-calcium; 6 shaft kilns; 90 tons a day; wood, producer gas; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer continuous 6-cylinder hydrator; open quarry.

Izard County: Ruddells—Batesville White Lime Co. (address, Batesville); high-calcium; 3 shaft kilns; 40 tons a day; quicklime (lump), construction, chemical; open quarry.

Searcy County: St. Joe—Arkansas Lime & Stone Co. (address, 120 East Third Street, Little Rock); high-calcium; 1 vertical kiln; 10 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction; Schaffer hydrator; open quarry.

Washington County: Johnson—Ozark White Lime Co. (address, Fayetteville); high-calcium; 6 vertical kilns; 75 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; tunnel quarry.

CALIFORNIA

Eldorado County: Diamond Spring—Diamond Spring Lime Co.; high-calcium, low-magnesium; 2 rotary kilns; 250 tons a day; oil; quicklime (lump, ground), construction, agriculture; hydrated, construction; Schulthess hydrator; open quarry.

Kern County: Tehachapi—Union Lime Co. (Inc.) (address, 2135 Bay Street, Los Angeles); high-calcium; 8 shaft kilns; 75 tons a day; producer gas; quicklime (lump), construction; hydrated, construction, agriculture; Schulthess hydrator; open quarry.

San Bernardino County:

Colton—California Portland Cement Co. (address, Los Angeles); high-calcium; 3 rotary kilns; 60 tons a day; oil; quicklime, construction, chemical.

Ludlow (Amboy P. O.)—Chubbuck Lime Co. (address, 5000 Worth Street, Los Angeles); high-calcium; 2 vertical kilns; 16 tons a day; oil; quicklime (lump), construction; open quarry.

San Mateo County: South San Francisco—Kunze Lime & Materials Co.; high-calcium; 2 vertical kilns; 14 tons a day; oil; quicklime (lump), construction, chemical. This company burns its lime from stone obtained from the Eldorado Lime & Minerals Co., Shingle Springs, Eldorado County. Idle in 1929.

Santa Cruz County:

Felton—Holmes Lime & Cement Co. (address, Division and DeHaro Streets, San Francisco); high-calcium; 4 pot kilns, 2 shaft kilns; 30 tons a day; oil; quicklime (lump), construction; hydrated, construction, agriculture; Clyde hydrator; open quarry; ready mixed mortar, wet and sanded.

Rincon—Henry Cowell Lime & Cement Co. (address, 2 Market Street, San Francisco); high-calcium; 3 pot kilns; 28 tons a day; oil; quicklime (lump), construction, chemical, agriculture; open quarry.

Tulare County: Lindsay—Abramson Bode Corporation (Universal Silicate Stucco & Lime Products Corporation) (address, 406 South Main Street, Los Angeles); high-calcium; 2 shaft kilns; 22 tons a day; oil; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; home-made batch hydrator; open quarry. Idle in 1929.

Tuolumne County: Sonora—United States Lime Products Corporation (address, 58 Sutter Street, San Francisco); high-calcium; 12 shaft kilns; 100 tons a day; oil; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; tunnel and open quarry.

COLORADO

El Paso County: Manitou—The Western Lime Co. (address, Equitable Building, Denver); high-calcium; 4 shaft kilns; 30 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Clyde hydrator; open quarry.

Fremont County: Calcite—Crystal Lime Co. (address, Continental Oil Building, Denver); low-magnesium; 1 shaft kiln; 6 tons a day; bituminous coal; quicklime (lump), construction, chemical.

La Plata County: Durango—Farmers Supply Co.; 1 pot kiln; 4 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction, chemical; open quarry.

Pueblo County: Pueblo—The Pueblo Lime Co.; high-calcium; 1 shaft kiln; 9 tons a day; bituminous coal; quicklime (lump), construction, chemical. Lime from stone furnished from quarry of J. F. Bell, Rockwood, La Plata County.

CONNECTICUT

Fairfield County: Canaan (near)—New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 7 shaft kilns; 70 tons a day; coal and wood, coke; quicklime (lump, ground), construction; hydrated, construction, agriculture; Clyde hydrator; open quarry.

Litchfield County:

- Canaan—Lee Lime Corporation (address, Lee, Mass.); high-magnesium; 6 shaft kilns; 90 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; open quarry.
- East Canaan—
  - Fred W. Barhoff (address, Hartford); high-magnesium, low-magnesium; 4 shaft kilns; 48 tons a day; bituminous coal and wood; quicklime (lump, granular), construction; open quarry.
  - New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 8 shaft kilns; 80 tons a day; coal and wood; quicklime (lump), construction, chemical, agriculture; open quarry.
- New Milford—New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 9 shaft kilns; 90 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry. Idle in 1929.

FLORIDA

Marion County:

- Kendrick—Dixie Lime Products Co. (address, Ocala); 4 pot kilns; 20 tons a day; wood; quicklime (lump), construction; hydrated, construction; Clyde hydrator; open quarry.
- Ocala—Florida Lime Co.; high-calcium; 5 shaft kilns; 25 tons a day; wood; quicklime (lump), construction; hydrated, construction; Clyde hydrator.
- Reddick—Commercial Lime Co. (address, Ocala); high-calcium; 10 shaft kilns; 50 tons a day; wood; quicklime (lump), construction; hydrated, mason's; Clyde hydrator; open quarry. Idle in 1929.

GEORGIA

Bartow County: Cartersville—Ladd Lime & Stone Co.; high-magnesium; 8 shaft kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, agriculture; hydrated, construction; Clyde hydrator; open quarry.

IDAHO

Kootenai County: Bayview—Washington Brick, Lime & Sewer Pipe Co. (address, Spokane, Wash.); high-calcium, high-magnesium; 5 shaft kilns; 30 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

HAWAII

Oahu: Honolulu—Waianae Lime Co.; high-calcium; 1 rotary kiln; 30 tons a day; oil; quicklime (pebble), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator.

ILLINOIS

Adams County:

- Marblehead—Marblehead Lime Co. (address, 160 North La Salle Street, Chicago); high-calcium; 2 shaft kilns, 5 gas kilns; 100 tons a day; producer gas; quicklime (lump, ground), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; tunnel and open quarry.
- Quincy—
  - Black White Lime Co.; high-calcium; 5 shaft kilns; 50 tons a day; bituminous coal; quicklime, construction, chemical; tunnel quarry.
  - Marblehead Lime Co. (address, 160 North La Salle Street, Chicago); high-calcium; 4 shaft kilns; 40 tons a day; coal and wood; quicklime (lump), construction, chemical, agriculture.
  - Menke Stone & Lime Co.; high-calcium; 3 shaft kilns; 37½ tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; tunnel and open quarry.

Cook County:

Chicago—

Marblehead Lime Co. (address, 160 North La Salle Street); high-calcium; 2 rotary kilns; 300 tons a day; oil; quicklime (pebble, ground), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; stone for burning purchased from Michigan Limestone & Chemical Co., Rogers City, Mich., and from the vicinity of Chicago.

Stearns Lime & Stone Co. (address, 154 West Randolph Street); high-magnesium; 6 shaft kilns; 60 tons a day; shavings and manure; quicklime (lump), construction.

Riverside—Riverside Lime & Stone Co. (address, 131 West Sixty-third Street, Chicago); high-magnesium; 6 pot kilns; 216 tons a day; bituminous coal; quicklime (lump), construction; open quarry.

Rock Island County: Cordova—United States Gypsum Co. (address, 300 West Adams Street, Chicago); high-magnesium; 8 shaft kilns; 80 tons a day; bituminous coal; hydrated, construction; Clyde hydrator; open quarry.

INDIANA

Cass County: Logansport—The Logansport Stone & Lime Co. (address, Huntington); high-calcium, high-magnesium; 6 vertical kilns; 50 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; hydrated, mason's, chemical, agriculture; Clyde hydrator.

Harrison County: Milltown (near)—Louisville Cement Co. (address, 315 Guthrie Street, Louisville, Ky.); low-magnesium, high-calcium; 3 pot kilns, 2 gas kilns, 1 rotary kiln; 125 tons a day; bituminous coal, producer gas; quicklime (lump, pebble, granular), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; tunnel and open quarry.

Huntington County: Huntington—Kelley Island Lime & Transport Co. (address, Cleveland, Ohio); high-magnesium; 18 vertical kilns; 144 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.

Lawrence County:

Bedford—Indiana Limestone Co.; high-calcium; 7 shaft kilns; 68 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical.

Mitchell—Lehigh Lime Co. (address, Allentown, Pa.); high-calcium; 18 shaft kilns; 300 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.

Putnam County: Putnamville—Indiana State Farm; lime burned for use on State farm; quicklime (lump), construction.

Washington County: Salem—

Hoosier Lime Co.; high-calcium; 5 shaft kilns; 60 tons a day; bituminous coal; quicklime (lump), construction, chemical; mine.

Salem Lime & Stone Co.; high-calcium; 2 shaft kilns; 25 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; hydrated, construction, chemical; Schulthess hydrator; open quarry.

IOWA

Jackson County: Maquoketa—A. A. Hurst; high-magnesium; 4 shaft kilns; 60 tons a day; anthracite; quicklime (lump), construction; open quarry.

KENTUCKY

Rockcastle County: Pine Hill—Rockcastle Cement & Lime Co. (address, Mount Vernon); high-calcium; 5 shaft kilns; 50 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical, agriculture; hydrated, mason's, chemical, agriculture; Clyde hydrator; mine.

MAINE

Knox County:

Rockland, Rockport, and Thomaston—Rockland-Rockport Lime Corporation (address, Rockland); high-calcium; 26 flame kilns, 6 gas kilns; 400 tons a day; bituminous coal, producer gas, wood; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Kritzer hydrator; ready-mixed dry plaster; open quarry.

Thomaston—

A. J. Bird (address, Rockland); high-magnesium; 1 shaft kiln; 16 tons a day; wood; quicklime (lump), construction, agriculture; open quarry.

J. A. Creighton & Co.; high-calcium; 9 shaft kilns; 80 tons a day; wood; quicklime (lump), construction, agriculture; open quarry.

Lawrence Portland Cement Co. (address, 302 Broadway, New York, N. Y.); high-calcium; 2 shaft kilns; 70 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; hydrated, construction, agriculture; Schulthess hydrator; open quarry.

MARYLAND

Allegany County: Small plants for local supply.

Baltimore County:

Texas—W. P. Lindsay; high-calcium; 4 pot kilns; 30 tons a day; bituminous coal and wood; quicklime, construction; open quarry. Lessee plant of Maryland Calcite Co.

Other small plants for local supply.

Carroll County: Wakefield—John S. Hyde (address, Westminster); low-magnesium; 3 pot kilns; 10 tons a day; anthracite; quicklime (lump), agriculture; open quarry.

Frederick County:

Buckeystown—O. J. Keller Lime Co. (address, Frederick); high-calcium; 7 pot kilns; 125 tons a day; coke; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.

Frederick—

M. J. Grove Lime Co. (address, Lime Kiln); low-magnesium; 10 pot kilns, 6 flame kilns; 200 tons a day; coal and coke; quicklime (lump, ground), construction, agriculture; hydrated, construction, agriculture; Clyde hydrator; open quarry.

Shank & Etzler; high-magnesium; 6 pot kilns; 25 tons a day; anthracite and coke; quicklime (lump, ground to 20-mesh), agriculture; hydrated, agriculture; open quarry.

Le Gore—Le Gore Lime Co.; high-calcium; 17 pot kilns; 200 tons a day; anthracite and coke; quicklime (lump, ground), agriculture; hydrated, mason's, agriculture; Schaffer continuous hydrator; open quarry.

Thurmont—H. M. Spahr Lime & Stone Co.; high-magnesium; 3 pot kilns; 25 tons a day; coke; quicklime, agriculture; open quarry.

Walkersville—Stoner & Powell (successor to Fountain Rock Lime Co.) (address, Woodsboro); low-magnesium; 8 pot kilns; 40 tons a day; coke, anthracite; quicklime (lump, ground), agriculture; open quarry.

Woodsboro—S. W. Barrick & Sons; high-calcium, low-magnesium; 20 pot kilns; 150 tons a day; anthracite and coke; quicklime, agriculture; hydrated, agriculture.

MASSACHUSETTS

Berkshire County:

Adams—New England Lime Co. (address, Pittsfield); high-calcium; 5 rotary kilns; 200 tons a day; oil; quicklime (granular), construction, chemical; hydrated, construction, chemical, agriculture; No. 4 Kritzer 6-cylinder hydrator; open quarry.

Farnams—Farnam-Cheshire Lime Co.; high-calcium; 14 shaft kilns, 7 gas kilns; 250 tons a day; producer gas, coal and wood; quicklime (lump, granular), construction, chemical, agriculture; hydrated, construction; open quarry.

Lee—Lee Lime Corporation; high-magnesium; 10 flame kilns; 150 tons a day; bituminous coal; quicklime (lump), chemical; hydrated, mason's, finishing; Kritzer hydrator; open quarry.

Sheffield—Berkshire Hills Co.; high-calcium, low-magnesium; 1 rotary kiln; 60 tons a day; oil; quicklime (lump, granular), construction, chemical, agriculture; open quarry.

West Stockbridge—

Lee Lime Corporation (address, Lee) (Tobey Plant); high-calcium; 2 flame kilns, 1 rotary kiln; 50 tons a day; wood, oil; quicklime (lump, granular, ground), construction, agriculture; open quarry.

Miller Lime Products Corporation; high-calcium, low-magnesium; 8 flame kilns; 100 tons a day; bituminous coal; quicklime (lump, granular, ground), construction, agriculture; hydrated, construction; Clyde hydrator; open quarry.

New England Lime Co. (address, Pittsfield) (Rockdale Plant); low-magnesium; 1 rotary kiln; 50 tons a day; oil; quicklime (granular), construction, chemical; open quarry.

Zylonite—Hoosac Valley Lime Co. (Inc.) (address, Adams); high-calcium; 4 shaft kilns, 2 rotary kilns; 80 tons a day; oil; quicklime (lump, granular, ground), construction, chemical, agriculture; open quarry.

MICHIGAN

Charlevoix County: Bayshore—Northern Lime & Stone Co. (address, Petoskey); high-calcium, high-magnesium, low-magnesium; 5 shaft kilns; 50 tons a day; wood; quicklime (lump), construction, agriculture; hydrated, mason's, chemical, agriculture; open quarry. Plant discontinued in December, 1929.

Cheboygan County: Afton—Campbell Stone Co. (address, Indian River); high-calcium; 2 rotary kilns; 125 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; open quarry.

Emmet County: Petoskey—

Antrim Lime Co. (address, Grand Rapids); low-magnesium; 2 vertical kilns; 23 tons a day; wood; quicklime, chemical; open quarry.

Northern Lime & Stone Co.; high-calcium, high-magnesium, low-magnesium; 5 shaft kilns; 40 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Clyde hydrator; open quarry.

Menominee County: Menominee—Limestone Products Co. (Central West Coal Co.); high-calcium; 12 shaft kilns; 168 tons a day; bituminous coal; quicklime (lump, pebble), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; stone for burning purchased from Michigan Limestone & Chemical Co., Rogers City.

Schoolcraft County: Calspar—Inland Lime & Stone Co.; high-calcium; 4 vertical kilns; 100 tons a day; producer gas; quicklime (lump, pebble, ground), chemical; hydrated, chemical; Clyde hydrator.

MINNESOTA

Blue Earth County: Mankato—Mankato Lime Co.; high-magnesium; 2 flame kilns; 20 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction; Clyde hydrator; open quarry.

Mower County: Le Roy—Fowler & Pay (address, Mankato); high-calcium; 2 shaft kilns; 16 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

St. Louis County: Duluth—Cutler-Magner Co.; high-magnesium, low-magnesium; 13 shaft kilns; 60 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Clyde hydrator. Stone from which lime is made is from quarries of the Kelley Island Lime & Transport Co. (address, Cleveland, Ohio).

MISSOURI

Greene County:

Ash Grove—Ash Grove Lime & Portland Cement Co. (address, Grand Avenue Temple, Kansas City); high-calcium; 11 flame kilns; 130 tons a day; wood; quicklime (lump, granular), construction, chemical; hydrated, construction, chemical; Clyde hydrator; open quarry.

Galloway—Ash Grove Lime & Portland Cement Co. (address, Grand Avenue Temple, Kansas City); high-calcium; 4 shaft kilns; 110 tons a day; bituminous coal; quicklime (lump, granular, ground), construction, chemical; hydrated, construction, chemical; Schaffer hydrator; open quarry.

Springfield—Marblehead Lime Co. (address, 160 North La Salle Street, Chicago, Ill.); high-calcium; 9 shaft kilns; 100 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; tunnel and open quarry.

Jefferson County: Glen Park (P. O., Sulphur Springs)—Glencoe Lime & Cement Co. (address, 915 Olive Street, St. Louis); high-calcium; 2 gas kilns; 50 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator.

Lawrence County: Pierce City—Pierce City Lime Co.; high-calcium; 3 shaft kilns; 30 tons a day; wood; quicklime (lump), construction; hydrated, construction, chemical, agriculture; Schulthess hydrator; open quarry.

Marion County: Hannibal (near)—Marblehead Lime Co. (address, 160 North La Salle Street, Chicago, Ill.); high-calcium; 4 flame kilns; 50 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; tunnel and open quarry.

St. Clair County: Osceola—

Missouri Lime & Mining Co. (address, Commerce Building, Kansas City) (lessee of Osceola Lime (Inc.), June, 1929); high-calcium; 5 shaft kilns; 30 tons a day; coke breeze; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical; underground and open quarry.

Osceola Lime (Inc.); high-calcium; 5 shaft kilns; 30 tons a day; wood; quicklime (lump), chemical; hydrated, construction, chemical; underground and open quarry; leased in June, 1929, to Missouri Lime & Mining Co.

Ste. Genevieve County:

Brickeys—Arrowhead Manufacturing Co. (address, St. Louis); high-calcium; 4 vertical kilns; 36 tons a day; bituminous coal; quicklime (lump), construction, chemical; underground quarry.

Ste. Genevieve—

Bluff City Lime & Stone Co. (address, Alton, Ill.); high-calcium; 12 vertical kilns; 250 tons a day; bituminous coal; quicklime (lump, pebble, granular), construction, chemical; hydrated, construction, chemical, agriculture; Kritzer hydrator; underground and open quarry.

Peerless White Lime Co. (address, Louderman Building, St. Louis); high-calcium; 9 shaft kilns; 260 tons a day; bituminous coal, producer gas; quicklime (lump, ground), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; underground quarry.

Ste. Genevieve Lime & Quarry Co. (address, Ambassador Building, St. Louis); high-calcium; 7 vertical kilns; 200 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; hydrated, mason's, chemical, agriculture; Clyde hydrator; underground and open quarry.

Western Lime Works; high-calcium; 6 gas kilns; 120 tons a day; producer gas; quicklime (lump, pebble), construction, chemical; hydrated, construction, chemical; Clyde hydrator; open quarry.

St. Louis County:

Centaur Station—Centaur Lime Co. (address, 3852 Market Street, St. Louis); high-calcium; 2 flame kilns; 30 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

Glencoe—Glencoe Lime & Cement Co. (address, 915 Olive Street, St. Louis); high-calcium; 6 shaft kilns; 56 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; underground and open quarry.

MONTANA

Deer Lodge County: Anaconda—Anaconda Copper Mining Co. (address, New York, N. Y.); high-calcium; 2 rotary kilns; 40 tons a day; bituminous coal; quicklime (pebble), chemical; open quarry.

Powell County: Elliston—Elliston Lime Co. (address, Helena); high-calcium; 3 steel draw kilns; 40 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction, chemical; Weber hydrator; open quarry.

NEVADA

Clark County: Sloan—United States Lime Products Corporation (address, 58 Sutter Street, San Francisco, Calif.); high-calcium; 2 rotary kilns, 3 shaft kilns; 170 tons a day; oil; quicklime (pebble, granular), construction, chemical; hydrated, construction, chemical; Clyde hydrator; open quarry.

NEW JERSEY

Somerset County: Peapack—Peapack Limestone Products Co.; high-magnesium; 2 pot kilns; 10 tons a day; anthracite; quicklime (lump), agriculture; hydrated, agriculture; Clyde hydrator.

NEW MEXICO

San Juan County: Kirtland—Edmund Thurland; construction; small plant for local supply.

San Miguel County: Las Vegas—The Canyon Lime Co. (address, East Las Vegas); high-calcium; 1 shaft kiln; 15 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

Santa Fe County: Santa Fe—New Mexico Penitentiary; 1 pot kiln; bituminous coal; construction; small plant for local supply.

NEW YORK

Clinton County: Chazy—Chazy Marble Lime Co. (Inc.); high-calcium; 12 shaft-kilns; 132 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; open quarry.

Dutchess County: Dover Plains—Kelley Island Lime & Transport Co. (address Cleveland, Ohio); high-magnesium; 6 shaft kilns; 60 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction, agriculture; Clyde hydrator.

Erie County: Buffalo—Kelley Island Lime & Transport Co. (address, Cleveland, Ohio); high-calcium; 2 rotary kilns; 200 tons a day; producer gas; quicklime (pebble), construction, chemical; hydrated, construction, chemical, agriculture; Schaffer hydrator. Stone burned at this plant is not quarried in New York but comes from quarries at Calcite, Mich.

Fulton County:

Gloversville—Willard A. Kegg; 1 pot kiln; 7 tons a day; wood; quicklime (lump), chemical; open quarry. Plant now abandoned.

Mayfield—Merl Haines; 1 kiln; 10 tons a day; wood; quicklime (lump), chemical.

Genesee County: Oakfield—United States Gypsum Co. (address, 300 West Adams Street, Chicago, Ill.); high-magnesium; 5 shaft kilns; 50 tons a day; bituminous coal; quicklime (lump, pebble), construction; hydrated, construction, agriculture; Clyde hydrator; open quarry.

Herkimer County: Jordanville—Mohawk Limestone Products Co. (address, Mohawk); low-magnesium; 1 rotary kiln; 75 tons a day; bituminous coal; hydrated, construction, agriculture; Weber hydrator.

Jefferson County: Natural Bridge—Basic Refractories Corporation (address, York, Pa.); high-magnesium; 2 rotary kilns; 80 tons a day; bituminous coal; dead-burned dolomite.

Seneca County: Seneca Falls—George M. Fisher; small plant for local supply.

Ulster County: Accord—H. L. Devoe; low-magnesium; 2 pot kilns; 16 tons a day; bituminous coal; quicklime (lump), chemical, agriculture.

Warren County: Glens Falls—

Finch, Pruyn & Co. (Inc.); high-calcium, low-magnesium; 3 field kilns; 60 tons a day; wood; quicklime, construction, chemical, agriculture. Plant abandoned in December, 1929.

F. W. Wait Lime Co.; high-calcium; 5 shaft kilns; 50 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical; Kritzer hydrator; open quarry.

Washington County: Smiths Basin—Chazy Marble Lime Co. (Inc.); (address, Chazy); high-calcium; 5 shaft kilns; 30 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture. Plane closed down in 1929.

NORTH CAROLINA

Henderson County: Fletcher—B. & C. Lime & Stone Co.; high-calcium; 4 shaft kilns; 24 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction; Clyde hydrator; open quarry.

OHIO

Adams County: Peebles—Basic Products Co. (address, Oliver Building, Pittsburgh, Pa.); high-magnesium; 6 rotary kilns; 480 tons a day; bituminous coal; quicklime (granular, ground), construction, chemical (dead-burned dolomite); hydrated, construction, agriculture; Clyde hydrator; open quarry. The kilns are at Kenova, W. Va., and the quarry is at Peebles.

Clark County: Springfield—

John W. Jenkins & Son; high-magnesium; 3 shaft kilns; 28 tons a day; natural gas; quicklime (lump), construction, chemical; hydrated, construction; open quarry.

The Moores Lime Co.; high-magnesium; 8 shaft kilns; natural gas; quicklime (lump, pebble, granular, ground to 20-mesh), construction, chemical, agriculture, dead-burned dolomite; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.

National Mortar & Supply Co. (address, Federal Reserve Building, Pittsburgh, Pa.); high-magnesium; 10 shaft kilns; 100 tons a day; bituminous coal; quicklime (lump, ground to 16-mesh), construction, chemical, agriculture; hydrated, construction, agriculture; Lauman hydrator; underground mine and open quarry.

Delaware County: Delaware—Scioto Lime & Stone Co.; low-magnesium; 18 shaft kilns; 150 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; American hydrator; open quarry.

Franklin County: Columbus—The Marble Cliff Quarries Co.; low-magnesium; 2 rotary kilns; 160 tons a day; producer gas; quicklime (pebble, ground), construction, chemical; hydrated, construction, chemical, agriculture; Schaffer hydrator; open quarry.

Greene County: Cedarville—Carter N. Abel (Inc.); high-magnesium; 3 flame kilns; 40 tons a day; bituminous coal; quicklime (lump), chemical; open quarry.

Hardin County: Forest—The Herzog Lime & Stone Co.; high-magnesium; 12 shaft kilns; 125 tons a day; bituminous coal, natural gas; quicklime (lump, ground to 20-mesh), chemical; hydrated, construction; Clyde hydrator; open quarry.

Marion County: Owens—John D. Owens & Co.; high-calcium; 10 shaft kilns; 50 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; open quarry.

Ottawa County:

Clay Center—Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 53 shaft kilns, 1 rotary kiln; 524 tons a day; bituminous coal, producer gas; quicklime (lump, ground), chemical, agriculture; hydrated, construction, agriculture; Clyde hydrator; open quarry.

Genoa—United States Gypsum Co. (address, 300 West Adams Street, Chicago, Ill.); high-magnesium; 40 shaft kilns, 2 rotary kilns; 650 tons a day; bituminous coal, producer gas; hydrated, construction; Schaffer hydrator; open quarry.

Marblehead—Kelley Island Lime & Transport Co. (address, Cleveland); high-calcium, low-magnesium; 25 shaft kilns; 200 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde and Carson hydrators; open quarry.

Sandusky County:

Gibsonburg—

France Lime Products (Inc.) (address, Toledo) (successor to Wm. L. Urschel Lime & Stone Co., October, 1929); high-magnesium; 18 shaft kilns; 250 tons a day; bituminous coal; hydrated, construction; Clyde hydrator; open quarry.

Gibsonburg Lime Products Co.; high-magnesium; 8 shaft kilns; 100 tons a day; bituminous coal; hydrated, construction, agriculture; Weber hydrator; open quarry.

Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 26 flame kilns; 176 tons a day; bituminous coal; quicklime (lump, ground), chemical; hydrated, construction; Lauman hydrator; open quarry.

National Mortar & Supply Co. (address, Federal Reserve Building, Pittsburgh, Pa.); high-magnesium; 35 shaft kilns; 420 tons a day; producer gas; quicklime (lump, ground), chemical, agriculture; hydrated, construction, agriculture; Lauman hydrator; open quarry.

Woodville—

Bruns Hydrated Lime Co.; high-magnesium; 6 shaft kilns; 75 tons a day; bituminous coal; hydrated, construction, agriculture; Weber hydrator; open quarry. Company in receivership.

The Ohio Hydrate & Supply Co.; high-magnesium; 36 shaft kilns; 600 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; hydrated, construction, chemical, agriculture; Schaffer hydrator; open quarry.

The Washington Building Lime Co. (address, Equitable Building, Baltimore, Md.); high-magnesium; 32 flame kilns, 1 rotary kiln; 550 tons a day; bituminous coal, producer gas; hydrated, construction; Clyde and Weber hydrators; open quarry.

The Woodville Lime Products Co. (address, 2140 Jefferson Avenue, Toledo); high-magnesium; 53 shaft kilns; 750 tons a day; bituminous coal; hydrated, construction, agriculture; Clyde hydrator; open quarry.

Seneca County:

Bettsville—Kennedy Refractories Co. (address, Tiffin); high-magnesium; 4 rotary kilns; 250 tons a day; bituminous coal; quicklime, dead-burned dolomite; open quarry.

Maple Grove—The Dolomite Products Co.; high-magnesium; 3 rotary kilns; 250 tons a day; bituminous coal; quicklime, dead-burned dolomite.

Tiffin—Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 5 shaft kilns; 30 tons a day; quicklime (ground), chemical; open quarry.

Stark County: Bolivar (near)—W. C. Allman (Buckeye Lime Plant); 1 draw kiln; coal; agriculture; small plant for local supply.

Tuscarawas County: Zoar—Zoar Agricultural Lime Co.; agriculture; small plant for local supply.

Wood County: Luckey—National Gypsum Co. (successor to Luckey Lime & Supply Co.) (address, Jackson Building, Buffalo, N. Y.); high-magnesium; 8 shaft kilns; 100 tons a day; bituminous coal; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.

Wyandot County: Carey—National Lime & Stone Co. (address, Buckeye Commercial Bank, Findlay); high-magnesium; 26 shaft kilns; 346 tons a day; bituminous coal, producer gas; quicklime (lump, granular, ground), chemical; hydrated, construction, chemical, agriculture; Clyde and Schaffer hydrators; open quarry.

OKLAHOMA

Adair County: Watts—Southern White Lime Co. (address, Pierce City, Mo.); high-calcium; 1 flame kiln; 12 tons a day; wood; quicklime (lump), construction; open quarry. Idle in 1929.

Tulsa County: Sand Springs—J. S. Greer; chemical.

OREGON

Baker County: Huntington—Oregon Portland Cement Co. (address, Portland); high-calcium; 3 shaft kilns; 30 tons a day; wood; quicklime (lump), construction; open quarry.

Jackson County: Gold Hill—Lively Lime Products Co.; high-calcium; 1 shaft kiln; 6 tons a day; wood; quicklime (lump), construction, agriculture.

Wallowa County: Enterprise—Black Marble & Lime Co.; high-calcium; 3 shaft kilns; 30 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction; Kritzer hydrator; open quarry and mine.

PENNSYLVANIA

Adams County: Hanover (near)—Steacy & Wilton Co. (address, Wrightsville); high-calcium; 6 pot kilns, 6 shaft kilns; 100 tons a day; bituminous coal, coke; quicklime, construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator.

Armstrong County: Small plants at Dayton and Ford City and near New Bethlehem, for local supply.

Bedford County:

Everett—

Everett-Saxton Co. (Ashcom Plant); low-magnesium; 3 shaft kilns; 30 tons a day; bituminous coal; quicklime (lump, pebble), chemical, agriculture; hydrated, chemical, agriculture; Schulthess hydrator; open quarry.

A. M. McClure; 2 pot kilns; 4 tons a day; bituminous coal; quicklime, agriculture; open quarry.

Other small plants at Bedford, Buffalo Mills, Everett, Hyndman, Manns Choice, New Enterprise, New Paris, Osterburg, Salemville, and Saxton, for local supply.

Berks County: Robesonia—Small plants for local supply.

Blair County:

Duncansville—Duncansville Lime & Stone Co.; high-calcium, low-magnesium; 2 pot kilns; 12 tons a day; bituminous coal, wood; quicklime (lump), agriculture.

Roaring Spring—Roaring Springs Lime & Stone Co.; 2 pot kilns; bituminous coal; quicklime (lump), agriculture.

Other small plants at Claysburg and Martinsburg, for local supply.

Butler County: Branchton—Mercer Lime & Stone Co. (address, Mercer); high-calcium; 4 pot kilns; 28 tons a day; bituminous coal; agriculture.

Cambria County: Johnstown—Conemaugh Valley Lime & Coal Co.; high-calcium, low-magnesium; 3 pot kilns; 10 tons a day; bituminous coal; agriculture.

Center County:

Bellefonte—

American Lime & Stone Co. (Bell Mine No. 19); high-calcium; 6 shaft kilns, 2 rotary kilns; 330 tons a day; bituminous coal, producer gas; quicklime (lump, pebble, granular, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Schaffer hydrator; open and underground quarry.

Centre County Lime Co.; high-calcium; 6 shaft kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; open quarry.

Chemical Lime Co.; high-calcium; 10 shaft kilns; 125 tons a day; bituminous coal; quicklime (lump, pebble, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Schulthess hydrator; open quarry.

Valley View Lime Co.; high-calcium; 2 shaft kilns; 14 tons a day; bituminous coal; quicklime (lump), chemical, agriculture; hydrated, construction, chemical, agriculture; Schulthess hydrator; open quarry.

Pleasant Gap—Whiterock Quarries (address, Bellefonte); high-calcium; 18 flame kilns; 125 tons a day; bituminous coal; quicklime (lump, pebble, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.

Other small plants at Port Matilda, etc., for local supply.

Chester County: Devault—Warner Co. (Cedar Hollow and Knickerbocker Plants) (address, 1518 Walnut Street, Philadelphia); high-magnesium; 26 shaft kilns, 1 gas kiln, 1 rotary kiln; 710 tons a day; bituminous coal, producer gas; quicklime (lump), construction chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry; ready-mixed dry plaster. Acquired plant of Knickerbocker Lime Co. in 1929.

Clinton County: Salona—J. M. Walker; high-calcium; 6 tons a day; bituminous coal; quicklime (lump), agriculture.

Columbia County:

Almedia—B. W. Hess; 3 field kilns; quicklime, agriculture.

Bloomsburg—Baker Stone Co. (successor to Low Bros. & Co.); low-magnesium; 11 pot kilns; 60 tons a day; anthracite; quicklime (lump), agriculture.

Other small plants at Almedia and Bloomsburg, for local supply.

Cumberland County:

Newville—E. E. Kough; low-magnesium; 3 pot kilns; 12 tons a day; coke; quicklime (ground to 16-mesh), agriculture.

Other small plants at Greason and Newville, for local supply.

Dauphin County:

Paxtang—Bonnymead Farms (address, R. D., Harrisburg); high-calcium; 4 pot kilns; 20 tons a day; coke; quicklime (lump), construction, chemical, agriculture; open quarry.

Swatara Station—

H. E. Millard (successor to Walter T. Bradley) (address, Annville); high-calcium; 10 pot kilns, 4 gas kilns; 150 tons a day; coke, producer gas; quicklime (lump), chemical.

Reinhard Lime Works (address, Lebanon); high-calcium; 4 pot kilns; 30 tons a day; coke; quicklime, chemical, agriculture; open quarry.

Fayette County: Small plants at Markleysburg and near Scottdale, for local supply.

Franklin County:

Small plants at Chambersburg and Spring Run, for local supply.

Mercersburg—O. B. Rockwell Lime & Stone Co.; 2 pot kilns; 15 tons a day; anthracite; quicklime, construction, agriculture; open quarry.

Huntingdon County: Small plants at Orbisonia, near Saxton, and at Three Springs, for local supply.

Indiana County: Marion Center—Small plants for local supply.

Jefferson County:

Reynoldsville—Reynoldsville Lime Co.; high-calcium; 1 pot kiln; 15 tons a day; bituminous coal; quicklime (ground), agriculture; hydrated, agriculture.

Small plants at Brockwayville, Brookville, and Munderf, for local supply.

Juniata County: Small plants at Mifflin, Mifflintown, and Richfield, for local supply.

Lancaster County:

Billmeyer—J. E. Baker Co. (Bainbridge Plant) (address, York); high-calcium, high-magnesium, low-magnesium; 10 pot kilns, 15 flame kilns, 5 rotary kilns; 500 tons a day; bituminous coal, coke; quicklime (lump), chemical, agriculture, dead-burned dolomite; hydrated, construction; Clyde hydrator; open quarry.

Other small plants at Ephrata, Gap, Lititz, Manheim, Ronks, and Union Grove, for local supply.

Lawrence County:

Ellwood City—Newcastle Lime & Stone Co. (lessee, Consolidated Stone & Mining Co.) (address, Temple Building, New Castle); low-magnesium; 2 shaft kilns; 25 tons a day; bituminous coal; quicklime (lump), agriculture; hydrated, agriculture; Clyde hydrator; open quarry.

Rose Point—Rose Point Lime & Stone Co. (address, New Castle); high-calcium; 10 pot kilns; 150 tons a day; bituminous coal; quicklime (lump), agriculture; hydrated, construction, agriculture; open quarry.

Lebanon County:

Annville—

Annville Lime Co.; high-calcium, low-magnesium; 6 pot kilns; 40 tons a day; coke; hydrated, agriculture; Clyde hydrator; open quarry.

H. E. Millard; high-calcium; 4 vertical kilns; 50 tons a day; coke; quicklime (lump), chemical; open quarry.

Lebanon—

S. J. Lightner; high-calcium; 2 pot kilns; 16 tons a day; coke; quicklime (lump), chemical, agriculture; open quarry.

Thomas A. Wagner; low-magnesium; 5 pot kilns; 40 tons a day; coke; quicklime (lump), chemical, agriculture; open quarry.

Myerstown—
  John Ebling; high-calcium; 6 pot kilns; 25 tons a day; coke; quicklime (lump), chemical; open quarry.
  I. W. Peifer (address, Lebanon); high-calcium; 4 pot kilns; 28 tons a day; coke; quicklime (lump), chemical, agriculture; open quarry.
Palmyra—H. E. Millard (successor to Walter T. Bradley) (address, Annville); high-calcium; 13 vertical kilns; 150 tons a day; coke; quicklime (lump), chemical; open quarry.
Other small plants near Annville and at Avon, Lebanon, and Prescott, for local supply.

Lycoming County:
Jersey Shore—Pine Creek Lime & Stone Co.; high-calcium; 6 pot kilns: 30 tons a day; coke; quicklime (lump), agriculture; hydrated, agriculture; Clyde hydrator; open quarry.
Muncy—
  Henry Kilgus; high-calcium; 6 pot kilns; 20 tons a day; anthracite; quicklime (lump), agriculture.
  Reeder Lime & Stone Co.; high-calcium; 19 pot kilns; 75 tons a day; anthracite; quicklime (lump, ground), agriculture; open quarry.
Williamsport—West Branch Lime Co.; low-magnesium; 7 pot kilns; 25 tons a day; coke; quicklime (lump, ground), agriculture; hydrated, agriculture.
Other small plants at Elimsport, Hughesville, and Muncy, for local supply.

Mifflin County: Naginey—National Limestone Co.; low-magnesium; 5 pot kilns; 20 tons a day; coke; quicklime (lump), construction, agriculture; hydrated, agriculture; Schulthess hydrator; open quarry.

Monroe County: Stroudsburg (near)—Small plants for local supply.

Montgomery County:
Bridgeport—
  Pennsylvania Lime Products Co. (address, Philadelphia); high-magnesium, low-magnesium; 4 draw kilns; 30 tons a day; bituminous coal; quicklime; hydrated, construction, agriculture; Kritzer hydrator; open quarry. Plant taken over by Warner Co.; kilns closed down in July, 1929.
  Warner Co. (address, 1518 Walnut Street, Philadelphia) (McCoy and Merion (formerly operated by Merion Lime & Stone Co.) Plants); high-magnesium; 9 shaft kilns; 169 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.
Plymouth Meeting—
  The Philip Carey Manufacturing Co. (address, Lockland, Ohio); high-magnesium; 3 shaft kilns; 30 tons a day; coke; hydrated, agriculture. Idle in 1929.
  G. & W. H. Corson; high-magnesium; 6 shaft kilns; 100 tons a day; bituminous coal; quicklime (lump), construction, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.
  Cox Limestone & Lime Products Co.; high-magnesium; 4 flame kilns; 50 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction; Clyde hydrator.
Willow Grove—John J. Cannon; high-magnesium; 2 pot kilns; 15 tons a day; anthracite and bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Montour County:
Danville—Alonzo Mauser; 3 pot kilns; 20 tons a day; coke; quicklime, agriculture.
Other small plants at Danville, near Potts Grove, and at Strawberry Ridge, for local supply.

Northampton County: Portland—Luther Keller Co.; high-magnesium; 11 pot kilns; 50 tons a day; wood; quicklime, construction, agriculture.

Northumberland County: Small plants at Herndon, Turbotville, and Urban, for local supply.

Perry County: Small plants at New Bloomfield and Newport, for local supply.

Schuylkill County: Andreas—Andreas Quarry Co.; high-calcium; 2 pot kilns; quicklime, agriculture. Idle in 1929.

Snyder County: Mount Pleasant Mills (near)—Small plants for local supply.

Somerset County: Small plants at Acosta, Berlin, Harrison, Salisbury, and Shanksville, for local supply.

Union County: West Milton—Small plant for local supply.

Westmoreland County:

Mount Pleasant—Frank D. Barnhart; 1 pot kiln; 8 tons a day; bituminous coal; quicklime, construction, agriculture; open quarry.

Other small plants at Latrobe, Ligonier, Manor, and Mount Pleasant, for local supply.

York County:

Hellam—Emig Lime Co.; high-calcium; 6 pot kilns; 18 tons a day; anthracite; quicklime (lump), agriculture; open quarry.

Mount Wolf (Saginaw)—J. E. Baker Co. (address, York); high-magnesium; 10 shaft kilns; 70 tons a day; coke; dead-burned dolomite; open quarry.

Thomasville—

J. E. Baker Co. (address, York); high-calcium, low-magnesium; 2 pot kilns, 8 shaft kilns; 65 tons a day; bituminous coal; quicklime (lump, granular, ground), construction, chemical, agriculture; open quarry.

Thomasville Stone & Lime Co.; high-calcium, low-magnesium; 14 shaft kilns; 100 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; open quarry.

West York—Universal Gypsum & Lime Co. (address, 111 West Washington Street, Chicago, Ill.); high-calcium, low-magnesium; 3 pot kilns, 10 shaft kilns, 2 gas kilns; 251 tons a day; bituminous coal, producer gas; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; open quarry.

York—York Valley Lime & Stone Co.; high-calcium, low-magnesium; 12 shaft kilns; 80 tons a day; bituminous coal; quicklime (lump, pebble), construction; hydrated, mason's; Clyde hydrator; open quarry.

RHODE ISLAND

Providence County: Lincoln—Burton K. Harris (address, Saylesville); low-magnesium; 3 shaft kilns, 1 gas kiln; 25 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, construction, agriculture; Clyde hydrator; open quarry.

SOUTH DAKOTA

Lawrence County: Spearfish—H. H. Lewis; construction; small plant for local supply. Idle in 1929.

Meade County: Calcite—Homestake Mining Co. (address, Lead); high-calcium; 2 shaft kilns; 25 tons a day; wood; quicklime (lump), chemical; open quarry; product all used in works of company.

Pennington County: Rapid City—Black Hills Marble Quarries Corporation; high-calcium; 3 shaft kilns; lignite; Clyde hydrator. This company took over the Dakota Lime Co., formerly the property of the Black Hills Rock Products Co.

TENNESSEE

Coffee County: Summitville—Tennessee Cement & Lime Co.; high-calcium; 5 flame kilns; 50 tons a day; wood and coal; quicklime (lump, pebble), construction, chemical, agriculture; hydrated, mason's, agriculture; Clyde hydrator; open quarry.

Cumberland County: Crab Orchard—Southern States Lime Corporation (address, Charleston, S. C.); high-calcium; 6 vertical kilns; 60 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction; open quarry.

Dickson County: Burns—Jesse Allen Lime Co.; high-calcium; 5 shaft kilns; 45 tons a day; bituminous coal; quicklime (lump), construction; hydrated, construction; Clyde hydrator; open quarry.

Franklin County: Sherwood—The Gager Lime Manufacturing Co. (address, Provident Building, Chattanooga); high-calcium; 20 shaft kilns, 2 rotary kilns; 275 tons a day; bituminous coal, producer gas; quicklime, construction, chemical; hydrated, construction, chemical; Schaffer hydrator; mine.

Knox County: Knoxville—

The Curtin Lime Co.; high-calcium; 4 gas kilns; 100 tons a day; producer gas; quicklime (lump, pebble), construction, chemical, agriculture; open quarry.

Oliver King Sand & Lime Co.; high-calcium; 12 shaft kilns; 120 tons a day; bituminous coal, producer gas; quicklime (lump), construction, chemical; hydrated, construction, chemical; Schaffer hydrator; open quarry.

Knoxville Sand & Lime Co.; high-calcium; 6 shaft kilns; 50 tons a day; bituminous coal; quicklime (lump, pebble), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.

Williams Lime Manufacturing Co.; high-calcium; 6 shaft kilns, 6 gas kilns; 175 tons a day; bituminous coal, producer gas; quicklime (lump, pebble), construction, chemical, agriculture; hydrated, construction, chemical; Schaffer hydrator; open quarry.

TEXAS

Comal County: New Braunfels—Dittlinger Lime Co.; high-calcium; 7 shaft kilns; 90 tons a day; natural gas; quicklime (lump, pebble, ground to 1½-inch), construction, agriculture; hydrated, construction, chemical, agriculture; Clyde and Kritzer hydrators; open quarry.

Coryell County: Lime City—Universal Gypsum & Lime Co. (address, 111 West Washington Street, Chicago, Ill.); 3 shaft kilns; 24 tons a day; lignite; quicklime (lump), construction; hydrated, construction; Schulthess hydrator; open quarry.

El Paso County: El Paso—

The Atlas Lime Co.; high-calcium; 3 shaft kilns; anthracite; quicklime (lump), construction, chemical; open quarry.

El Paso Building Material Co.; low-magnesium; 6 pot kilns; 60 tons a day; anthracite; quicklime (lump), construction, chemical; open quarry.

Travis County: McNeil—Austin White Lime Co. (address, Austin); high-calcium; 8 shaft kilns; 100 tons a day; lignite; quicklime (lump), construction, chemical; hydrated, construction, chemical; Kritzer hydrator; open quarry.

Williamson County: Round Rock—Round Rock White Lime Co.; high-calcium; 6 shaft kilns; 60 tons a day; lignite; quicklime (lump), construction; hydrated, construction; Clyde hydrator; open quarry.

UTAH

Cache County: Logan—

Cache Valley Lime Co., Charles E. Peterson; construction; small plant for local supply.

Jacob P. Peterson Lime Co.; construction; small plant for local supply.

Iron County: Cedar City—Parry Lime Co.; construction; small plant for local supply.

Juab County: Eureka—Chief Consolidated Mining Co. (address, Salt Lake City); high-calcium; 2 pot kilns, 2 shaft kilns; 80 tons a day; coke; quicklime (lump), construction; hydrated, construction, chemical; Clyde hydrator; open quarry.

Salt Lake County:

Garfield—American Smelting & Refining Co. (address, 120 Broadway, New York, N. Y.) (Garfield Lime Burning Plant); 1 rotary kiln; 100 tons a day; coke. This plant sold in June, 1929, to Utah Copper Co.

Salt Lake City—

Langton Lime & Cement Co.; high-magnesium; 4 pot kilns; 24 tons a day; coke breeze; quicklime (lump), construction, chemical; open quarry.

Western Lime & Silica Co.; high-magnesium; 3 pot kilns; 28 tons a day; coke; quicklime (lump), construction; open quarry.

Summit County: Park City—Willard S. Thompson & Son (address, Beaver); 2 kilns; wood; quicklime (lump), construction.

Toole County: Grantsville—The Utah Lime and Stone Co. (address, Continental Bank Building, Salt Lake City); high-calcium, high-magnesium; 4 shaft kilns; 35 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, construction, chemical; Clyde hydrator; open quarry, Utah County: Provo—Giles & Peterson (Boardman's Kilns); low-magnesium; 3 pot kilns; 15 tons a day; coke breeze; quicklime (lump), construction; open quarry.

Weber County: Ogden—Ogden White Lime Co. (C. E. Pettegrew, proprietor); 2 pot kilns; 10 tons a day; coke; quicklime, construction, agriculture.

VERMONT

Addison County:

Brandon (near)—Leicester Lime Corporation; high-calcium; 3 shaft kilns; 36 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical; open quarry.

Leicester Junction—Brandon Lime & Marble Co.; high-calcium; 2 shaft kilns; 20 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical, agriculture; open quarry.

Middlebury—Green Mountain Lime Corporation (address, care of Brewer & Co., Worcester, Mass.); high-calcium; 5 pot kilns; 50 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.

Chittenden County: Winooski—Champlain Valley Lime Co. (address, care of Brewer & Co., Worcester, Mass.); high-calcium, low-magnesium; 4 pot kilns; 40 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; open quarry.

Franklin County:

St. Albans—Fonda Lime Kilns; high-calcium; 5 shaft kilns; 50 tons a day; coal and wood; quicklime (lump), construction, chemical.

Swanton—Swanton Lime Works; high-calcium; 5 gas kilns; 40 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; revolving batch hydrator; open quarry.

Rutland County: West Rutland—Vermarco Lime Co.; high-calcium; 2 rotary kilns; 105 tons a day; oil, producer gas; quicklime (granular), construction, chemical; hydrated, construction, chemical, agriculture; Kritzer hydrator; underground quarry.

Windsor County: Amsden—Amsden Lime Co. (address, Reading); high-magnesium; 3 shaft kilns; 30 tons a day; wood; quicklime (lump), construction; hydrated, construction; Kritzer continuous hydrator.

VIRGINIA

Augusta County: Small plants at Mount Solon, New Hope, and Staunton, for local supply.

Botetourt County:

Eagle Rock—

Eagle Rock Lime Co.; high-calcium; 4 shaft kilns; 40 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; hydrated, construction; Schaffer hydrator; open quarry.

Moore Lime Co.; high-calcium; 5 shaft kilns; 65 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.

Indian Rock—E. Dillon's Sons (Inc.); high-calcium; 3 shaft kilns; 45 tons a day; wood; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Schaffer hydrator; open quarry.

Frederick County:

Meadow Mills—Lloyd N. Connor; high-calcium; 1 pot kiln; 7 tons a day; quicklime (lump), construction; open quarry.

Stephens City—M. J. Grove Lime Co. (address, Lime Kiln, Md.); high-calcium; 20 shaft kilns; 300 tons a day; bituminous coal; quicklime (lump, pebble, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Schaffer hydrator; open quarry.

Giles County:

Kerns—Kimbalton Lime Co. (address, Shawsville); high-calcium; 3 shaft kilns; 40 tons a day; quicklime (lump), construction, chemical; hydrated, construction, agriculture; open quarry.

Ripplemead—New River Lime Co.; high-calcium; 4 pot kilns; 15 tons a day; bituminous coal; quicklime (lump), chemical, agriculture; open quarry.

Loudon County: Leesburg—Leesburg Lime Co. (Inc.); low-magnesium; 5 vertical kilns; 40 tons a day; bituminous coal; quicklime (lump, ground), agriculture; open quarry.

Montgomery County: Cambria—
  Dudley Bros.; low-magnesium; 2 pot kilns; 10 tons a day; anthracite; quicklime (lump), construction; open quarry.
  Ellett Lime Co. (address, Roanoke); 7 pot kilns; 35 tons a day; construction, agriculture. Idle in 1929.

Rockingham County:
  Bridgewater—Wheelbarger-Rumsey Lime Corporation; 1 pot kiln; 8 tons a day; wood; quicklime, agriculture.
  Harrisonburg—
    Harrisonburg Lime & Stone Corporation; high-calcium; 2 shaft kilns; 20 tons a day; bituminous coal; quicklime (lump, ground), construction, agriculture; open quarry. Idle in 1929.
    Other small plants near Harrisonburg, for local supply.
  Linville—Rockdale-Corson Lime Co. (Inc.) (address, Harrisonburg); high-calcium; 4 shaft kilns; 40 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; open quarry.

Russell County: Elk Garden—H. C. Stuart; agriculture.

Shenandoah County:
  Oranda—Universal Gypsum & Lime Co. (address, 111 West Washington Street, Chicago, Ill.); high-calcium; 8 shaft kilns; 65 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; open quarry.
  Strasburg—
    Corson Lime Co. of Virginia (address, Harrisonburg) (Capon Road Plant); high-calcium; 3 shaft kilns; 30 tons a day; bituminous coal; quicklime (lump), chemical.
    Strasburg Lime Co.; high-calcium; 4 shaft kilns; 40 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; open quarry.
  Strasburg Junction—
    Powhatan Lime Co.; high-calcium; 4 pot kilns, 6 shaft kilns; 100 tons a day; bituminous coal and wood; quicklime (lump, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde and Atlas hydrators; open quarry.
    Rockdale-Corson Lime Co. (Inc.) (address, Harrisonburg); high-calcium; 4-shaft kilns; 40 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.
  Toms Brook—Toms Brook Lime & Stone Co. (Inc.); high-calcium; 2 shaft kilns; 20 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; open quarry.

Tazewell County:
  Maxwell—Blue Grass Lime Co.; high-calcium, low-magnesium; 3 pot kilns; 24 tons a day; bituminous coal; quicklime (lump), agriculture.
  North Tazewell—Peery Lime Co. (Inc.); high-calcium; 4 pot kilns; 20 tons a day; bituminous coal; quicklime (lump, ground), construction, agriculture; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.
  Tazewell—Five Oaks Lime & Stone So.; high-calcium; 1 patent kiln, 2 pot kilns; 20 tons a day; bituminous coal; quicklime, construction, chemical, agriculture; open quarry.

Warren County:
  Front Royal—Limeton Lime Co.; high-calcium; 3 shaft kilns; 30 tons a day; wood and coal; quicklime (lump, ground), chemical, agriculture; hydrated, mason's, agriculture; Schulthess hydrator; open quarry.
  Riverton—Riverton Lime Co. (Inc.); high-calcium, low-magnesium; 5 shaft kilns, 3 pot kilns; 120 tons a day; anthracite, coke; quicklime (lump, granular, ground to 30-mesh), construction, agriculture; hydrated, construction, agriculture; Carson and Clyde hydrators; open quarry.

Washington County: Abingdon—Simpson & Crawford; agriculture; small plant.

WASHINGTON

San Juan County:

Friday Harbor—

Henry Cowell Lime & Cement Co. (address, Portland, Oreg.); low-magnesium; 2 shaft kilns; 10 tons a day; wood; quicklime (lump), construction; open quarry.

Orcas Lime Co. (address, Pioneer Building, Seattle); high-calcium; 1 shaft kiln; 10 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction; special hydrator with revolving drums; open quarry.

Roche Harbor Lime & Cement Co.; high-calcium; 13 patent kilns; 130 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, agriculture; Jameson hydrator; open quarry.

Stevens County: Bossburg—Idaho Lime Co.; high-calcium; 6 shaft kilns; 60 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical; Schulthess hydrator; open quarry.

WEST VIRGINIA

Berkeley County:

Jones Springs—J. H. Wheeler (address, Hedgesville); high-calcium; 1 pot kiln; 10 tons a day; quicklime, agriculture.

Martinsburg—

Blair Limestone Co. (address, Third Avenue and Ross Street, Pittsburgh, Pa.); high-calcium; 19 pot kilns; 285 tons a day; coke; quicklime (lump), chemical; hydrated, mason's, agriculture; Kritzer hydrator; open quarry.

North American Cement Corporation (address, Hagerstown, Md.); high-calcium; 3 shaft kilns; 150 tons a day; producer gas; quicklime (lump, ground), chemical, agriculture; hydrated, construction, chemical, agriculture; batch hydrator; open quarry.

Jefferson County:

Bakerton—The Washington Building Lime Co. (address, Equitable Building, Baltimore, Md.); high-calcium, low-magnesium; 6 pot kilns, 11 shaft kilns, 1 rotary kiln; 310 tons a day; bituminous coal, producer gas; quicklime (lump, granular, ground), construction, chemical, agriculture; hydrated, construction, chemical, agriculture; Clyde and Kritzer hydrators; underground and open quarry.

Millville—

Blair Limestone Co. (address, Third Avenue and Ross Street, Pittsburgh, Pa.); high-magnesium; 10 pot kilns; 150 tons a day; coke; quicklime (granular), chemical, agriculture; open quarry.

Standard Lime & Stone Co. (address, Baltimore, Md.); high-magnesium; 3 rotary kilns; dead-burned dolomite.

Monongalia County: Morgantown (near)—Small plant for local supply.

Preston County:

Terra Alta—Terra Alta Lime Co.; high-calcium; 4 pot kilns; 30 tons a day; bituminous coal; quicklime, agriculture.

Small plants near Clifton Mills, Terra Alta, and Tunnelton, for local supply.

WISCONSIN

Brown County: Green Bay—The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-calcium; 5 shaft kilns; 30 tons a day; wood; quicklime, chemical; stone used at this plant comes from Rogers City, Mich.

Calumet County:

Brillion—The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-magnesium; 10 shaft kilns; 104 tons a day; wood; quicklime, construction; hydrated, construction; open quarry.

Hayton—The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-magnesium; 4 shaft kilns; 47 tons a day; wood; quicklime, construction; open quarry.

Highcliff—The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-magnesium; 4 shaft kilns; 50 tons a day; wood; quicklime, construction; hydrated, construction.

Dodge County:
  Knowles (Nasbro)—
    Standard Lime & Stone Co. (address, Fond du Lac); high-magnesium; 5 shaft kilns; 60 tons a day; wood; quicklime, construction; hydrated, construction; Kritzer hydrator; open quarry.
    The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-magnesium; 5 shaft kilns; 65 tons a day; wood; quicklime, construction; hydrated, construction.
    Mayville—Mayville White Lime Works; high-magnesium; 3 shaft kilns; 50 tons a day; wood; quicklime (lump), construction; open quarry.
Door County: Egg Harbor—Small plant for local supply.
Fond du Lac County: Eden—
  Nast Lime & Stone Co.; plant under construction.
  The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee) (Marblehead Plant); high-magnesium; 10 shaft kilns; 120 tons a day; wood; quicklime, construction; hydrated, construction.
Manitowoc County:
  Francis Creek—Allwood Lime Co. (address, R. D., Manitowoc); high-magnesium; 4 shaft kilns, 1 gas kiln; 50 tons a day; wood; quicklime, construction, chemical; hydrated, construction; Clyde hydrator; open quarry.
  Grimms—The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee); high-magnesium; 9 shaft kilns; 100 tons a day; wood; quicklime, construction.
  Manitowoc—Rockwell Lime Co. (address, 228 North La Salle Street, Chicago, Ill.); high-magnesium; 4 pot kilns; 45 tons a day; wood; quicklime (lump, ground), construction, chemical; open quarry.
  Valders—
    Standard Lime & Stone Co. (address, Fond du Lac); high-magnesium; 5 shaft kilns; 60 tons a day; wood; quicklime, construction.
    Valders Lime & Stone Co.; high-magnesium; 5 vertical kilns; 60 tons a day; wood; quicklime, construction, chemical; open quarry.
    The Western Lime & Cement Co. (address, Trust Co. Building, Milwaukee (Quarry Plant); high-magnesium; 4 shaft kilns; 40 tons a day; wood; quicklime, construction.
Ozaukee County: Cedarburg—John F. Groth & Son; high-magnesium; 3 shaft kilns; 40 tons a day; wood; quicklime (lump, ground), construction, agriculture; open quarry.
Sheboygan County: Sheboygan—Sheboygan Lime Works; high-magnesium; 5 flame kilns; 60 tons a day; wood; quicklime (lump), construction, chemical; hydrated, construction, chemical, agriculture; Clyde hydrator; open quarry.
Washington County: Fredonia (near)—Emil Peterson; construction; small plant.

NATURAL GASOLINE[1]

By G. R. Hopkins and E. M. Seeley

SUMMARY

The natural-gasoline industry, noted for its rapid growth, established a new record for output in 1929, when a total of 2,233,688,000 gallons was produced. (See fig. 4.) This output represents an increase of 23 per cent over 1928, as compared with an increase of 11 per cent in 1928 over 1927 and an average annual increase of 21 per cent for the past 10 years. The record-breaking output of natural gasoline in 1929 was closely related to the material increase in crude-petroleum production. In 1929 crude-oil production for the first time exceeded 1,000,000,000 barrels and the total (1,007,323,000 barrels) represents an increase of 12 per cent over 1928. Although this rate of increase is considerably below the increase in natural-gasoline production, it should be noted that much of the flush crude oil obtained in 1929 came from deep sands in which the gas-oil ratio was high. Furthermore, there was a pronounced tendency to erect larger plants and, while the recovery per thousand cubic feet of gas treated at these plants was below the average, the large quantity of gas put through had a material effect on the total output for the year.

Another stimulating factor in 1929 in natural-gasoline production was the rapid growth in the utilization of natural gas. Several large interstate pipe lines were completed during the year, and the number of natural-gas consumers increased materially. The total consumption of natural gas increased 22 per cent, and as practically all the gas piped is treated for natural gasoline before it is turned into the lines the production of natural gasoline increased proportionally.

Summary of statistics for natural gasoline in the United States, 1925–1929

	1925	1926	1927	1928	1929
Number of plants operating	1,081	1,102	1,119	1,078	1,087
Production:					
By States—					
California ..... millions of gallons	303	389	498	584	840
Oklahoma ..... do	391	476	548	620	676
Texas ..... do	214	243	321	324	420
West Virginia ..... do	58	64	64	70	73
Louisiana ..... do	43	44	45	55	65
Other ..... do	118	147	165	161	160
	1,127	1,363	1,641	1,814	2,234
By types of process—					
Compression process ..... do	238	243	242	226	259
Absorption and combination processes ..... do	882	1,100	1,377	1,564	1,950
Charcoal ..... do	7	20	22	24	25
	1,127	1,363	1,641	1,814	2,234
Stocks at natural-gasoline plants at end of year ..... do	15	19	32	27	26
Value:					
Total (at plants) ..... millions of dollars	120	136	119	139	158
Average per gallon (at plant) ..... cents	10.7	10.0	7.2	7.7	7.1
Average spot price, Oklahoma natural gasoline, grade A ..... cents	12.0	9.5	5.9	7.4	7.1
Natural gas treated ..... millions of cubic feet	1,040,390	1,206,300	1,341,248	1,473,434	1,959,294
Average yield per thousand cubic feet ..... gallons	1.08	1.13	1.22	1.23	1.14

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[1] Work on manuscript completed October, 1930.

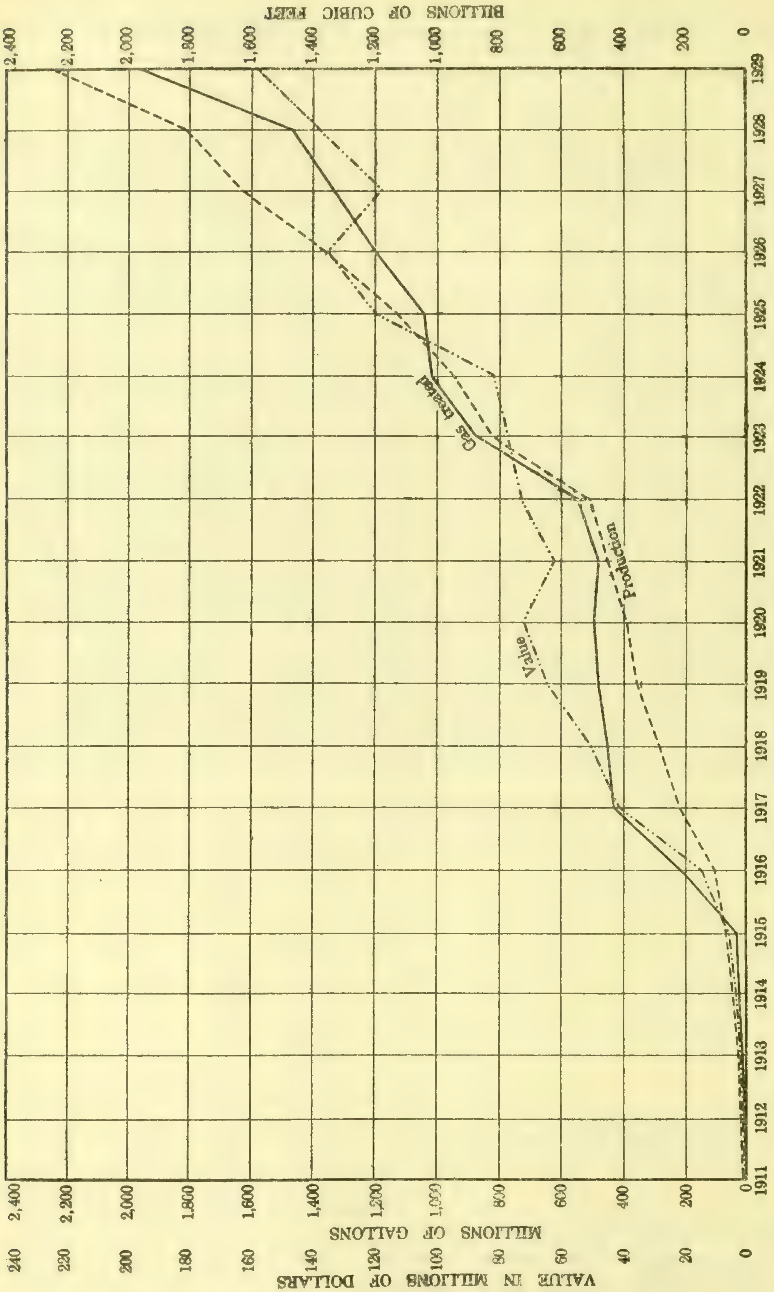

FIGURE 4.—Quantity and value of natural gasoline produced and volume of natural gas treated at plants, 1911–1929

Refiners, the chief users of natural gasoline, utilized 1,851,360,000 gallons of natural gasoline in blends in 1929, an increase of 32 per cent over 1928. (See fig. 5.) This material increase in the utilization of natural gasoline in 1929, in conjunction with a much smaller gain in total gasoline output (15 per cent), raised the ratio of natural gasoline utilized to the total gasoline production from 9.3 per cent in 1928 to 10.7 per cent in 1929.

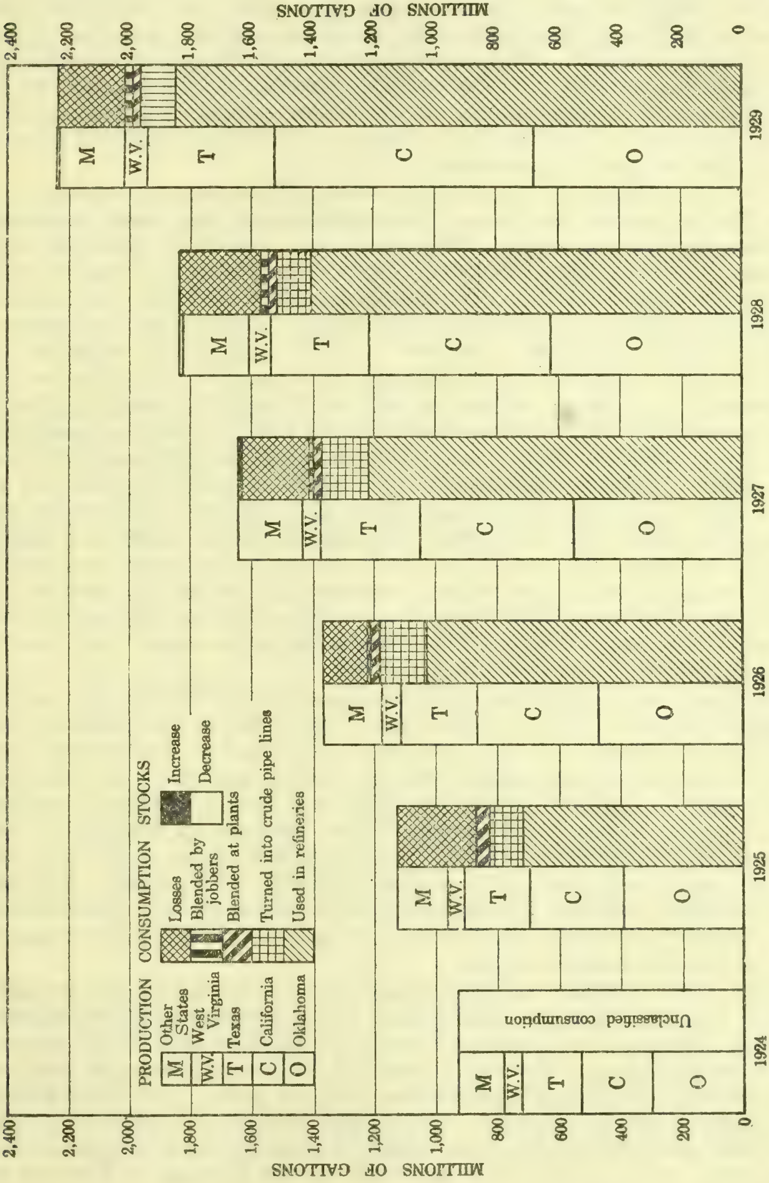

FIGURE 5.—Production and consumption of natural gasoline, 1924–1929

In spite of the material gain in output of natural gasoline in 1929, stocks held by the manufacturers at their plants showed a small decline. This fact indicates that the rapidly increasing output was readily absorbed by refiners, a situation that resulted more from the fact that the market was essentially a buyer's market than from a desire on the part of refiners to use more natural gasoline. However, it is probable that the small independent refiners, which comprise an important outlet for the natural gasoline not produced by the natural-gasoline departments of the major refining companies, made some progress in 1929 in the technique of blending natural gasoline with the straight-run product.

The advisability of constructing storage facilities for natural gasoline for utilization in times of overproduction has been frequently discussed in recent years. The fact that the high point in stock accumulation in 1929 (58,400,000 gallons on May 31) was considerably above the 1928 high (35,400,000 gallons on March 31) indicates a slight increase in natural-gasoline storage facilities at the plants.

The natural gasoline produced in 1929 had a total value at the plants of $158,410,000 which, although the highest total ever recorded, represents an average value per gallon of only 7.1 cents, the lowest ever recorded. This figure agrees closely with the average spot price for grade A Oklahoma natural gasoline which in 1929 was 7.05 cents per gallon. Spot prices were at their highest at the beginning of the year but soon fell as production increased rapidly. The lowest spot prices recorded in 1929 were slightly above 6 cents per gallon, probably above the cost of production; the lowest price recorded in 1928 was 4.13 cents per gallon, undoubtedly below the cost of production. In general, 1929 was a year of low prices, with no extreme fluctuations, as contrasted with 1928, when prices more than doubled over a period of less than four months.

Production in California in 1929 amounted to 840,325,000 gallons, an increase over 1928 of 44 per cent. By virtue of this material gain, California became for the first time the leading producing State. Oklahoma and Texas, which ranked second and third, respectively, each reported gain in output in 1929, and with California produced 87 per cent of the total output. The increase in California came largely from the Sante Fe Springs field where rapid drilling of deep sands made large quantities of gas available for treating. The gain in Oklahoma followed the active development of the Seminole district, and that in Texas was an aftermath of the growing demand for natural gas in the Panhandle region.

The rapid increase in production in California and the resultant surplus supply were the chief causes of the extensive coastwise movements through the Panama Canal to Atlantic and Gulf ports in the United States. Such shipments in 1929 to the Atlantic seaboard amounted to 30,786,000 gallons and to Gulf ports, 12,054,000 gallons. Exports of natural gasoline, comprising tanker shipments and tank-car deliveries to Canada, undoubtedly increased in 1929; such exports, however, are not separately recorded by the Bureau of Foreign and Domestic Commerce.

The industry improved its economic position in 1929 by increasing the production of stabilized natural gasoline and by developing by-products. These go hand in hand because the principal by-product is liquefied gas, or propane and butane, removed from the raw natural gasoline in the process of stabilization. Stabilizing yields three main benefits to the manufacturer; namely, a more uniform product, a natural gasoline that has superior handling qualities and can be shipped in bulk, and a by-product—liquefied petroleum gas—which is rapidly increasing in importance.

PRODUCTION

Natural gasoline produced in the United States, 1920–1929, by States, in thousands of gallons

Year	Alaska	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	New Mexico	New York
1920	--------	--------	48,208	--------	6,055	--------	4,331	4,497	10,610	--------	411
1921	--------	--------	58,220	--------	7,536	--------	3,587	4,242	15,341	--------	366
1922	--------	4,289	67,120	--------	7,760	--------	2,856	5,205	29,406	--------	506
1923	--------	16,183	173,329	--------	7,356	--------	8,775	7,601	40,720	--------	408
1924	--------	17,533	232,579	--------	9,091	--------	11,658	7,274	48,098	--------	477
1925	33	19,686	303,180	35	9,874	--------	19,592	7,685	43,489	--------	414
1926	33	30,385	389,366	276	9,987	--------	25,369	7,689	43,557	1.488	539
1927	19	37,498	498,020	912	8,853	--------	36,095	7,480	44,844	1,827	449
1928	26	32,677	584,111	1,909	7,817	--------	36,765	7,267	55,022	1,506	392
1929	35	33,455	840,325	1,630	7,080	2	36,227	6,006	64,957	1,077	264

Year	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Total		
							Thousands of gallons	Value at plant	
								Thousands of dollars	Average per gallon (cents)
1920	10,016	178,857	21,151	32,956	58,941	8,711	384,744	71,788	18.7
1921	9,100	185,341	19,856	77,141	54,646	14,558	449,934	61,815	13.7
1922	8,600	189,404	18,518	95,405	56,796	19,967	505,832	72,711	14.4
1923	10,035	270,249	19,132	177,765	63,381	21,292	816,226	77,268	9.5
1924	9,443	301,062	19,254	186,571	61,549	29,272	933,861	82,233	8.8
1925	8,701	390,861	18,850	214,092	58,201	32,777	1,127,470	120,383	10.7
1926	10,817	475,716	20,343	243,093	63,807	40,625	1,363,090	136,412	10.0
1927	12,167	548,109	16,744	320,723	64,192	43,212	1,641,144	118,688	7.2
1928	13,174	619,691	16,571	324,516	69,729	42,861	1,814,034	138,944	7.7
1929	11,166	676,030	18,411	419,485	72,994	44,544	2,233,688	158,410	7.1

The average yield of natural gasoline per thousand cubic feet of gas treated fell from 1.23 gallons in 1928 to 1.14 gallons in 1929. This is the first decline in average yield since 1924. All three of the leading producing States showed a decline in yield in 1929—California fell from 1.54 to 1.36 gallons, Oklahoma from 2.25 to 2.15, and Texas from 1.05 to 0.87. The lowest yields reported for 1929 were in Ohio and Kentucky, both eastern States; the highest, 2.87, was credited to Arkansas.

Natural gasoline produced and natural gas treated in the United States, 1928 and 1929, by States

State	Number of operators reporting[1]	Number of plants operating	Raw (unblended) gasoline produced			Estimated quantity of natural gas treated	
			Thousands of gallons	Value at plant		Millions of cubic feet	Average yield per M cubic feet (gallons)
				Thousands of dollars	Average per gallon (cents)		
1928							
Alaska	1	1	26	3	11.5	20	1.30
Arkansas	11	14	32,677	2,568	7.9	13,030	2.51
California	52	147	584,111	53,885	9.2	380,059	1.54
Colorado	2	2	1,909	136	7.1	3,498	.55
Illinois	23	78	7,817	585	7.5	2,999	2.61
Kansas	14	25	36,765	2,444	6.6	33,091	1.11
Kentucky	10	12	7,267	575	7.9	25,801	.28
Louisiana	27	49	55,022	3,434	6.2	129,513	.42
New Mexico	1	1	1,506	107	7.1	731	2.06
New York	3	3	392	45	11.5	411	.95
Ohio	16	35	13,174	1,146	8.7	49,572	.27
Oklahoma	95	297	619,691	40,959	6.6	275,961	2.25
Pennsylvania	86	131	16,571	1,570	9.5	49,542	.33
Texas	57	156	324,516	22,492	6.9	309,769	1.05
West Virginia	42	118	69,729	6,220	8.9	164,120	.42
Wyoming	7	9	42,861	2,775	6.5	35,317	1.21
	[1] 369	1,078	1,814,034	138,944	7.7	1,473,434	1.23
1929							
Alaska	1	1	35	4	11.4	27	1.30
Arkansas	11	14	33,455	2,419	7.2	11,644	2.87
California	48	153	840,325	67,009	8.0	617,648	1.36
Colorado	2	3	1,630	113	6.9	1,880	.87
Illinois	23	78	7,080	617	8.7	2,760	2.57
Indiana	1	1	2	(2)	----------	2	1.00
Kansas	15	26	36,227	2,207	6.1	47,565	.76
Kentucky	7	9	6,006	486	8.1	23,479	.26
Louisiana	25	48	64,957	4,010	6.2	153,370	.42
New Mexico	1	1	1,077	71	6.6	555	1.94
New York	3	3	264	22	8.3	598	.44
Ohio	15	33	11,166	923	8.3	43,901	.25
Oklahoma	95	292	676,030	42,766	6.3	314,649	2.15
Pennsylvania	91	136	18,411	1,676	9.1	50,789	.36
Texas	56	159	419,485	26,561	6.3	479,543	.87
West Virginia	42	122	72,994	6,285	8.6	177,606	.41
Wyoming	5	8	44,544	3,241	7.3	33,278	1.34
	[1] 364	1,087	2,233,688	158,410	7.1	1,959,294	1.14

[1] A producer operating in more than one State is counted only once.
[2] Less than $500.

The number of plants using the compression and charcoal processes continued to decline in 1929. On the other hand, the number of plants using the absorption process, or a combination of the absorption process and the compression or charcoal processes, again increased. The decline in the number of compression plants during 1929 was much less than in 1928, indicating that most of the small, inefficient plants were dismantled during or before 1928.

The number of plants using the compression process during 1929 totaled 442, compared with 620 plants using the absorption and combination processes. On the basis of production, the relative importance of the absorption method was even more pronounced; the total production at the compression plants in 1929 was only 258,937,000 gallons, compared with a total production of 1,950,150,000 gallons at plants using the absorption and combination processes.

Plants using the charcoal process declined in number in 1929 but registered a small increase in total output. Charcoal plants are centered chiefly in West Virginia.

Natural gasoline produced in the United States, 1928 and 1929, by States and by methods of manufacture

State	Number of plants operating			Raw (unblended) gasoline produced (thousands of gallons)		
	Compression	Absorption including combination absorption process with compression and charcoal processes	Charcoal	Compression	Absorption including combination absorption process with compression and charcoal processes	Charcoal
1928						
Alaska		1			26	
Arkansas	1	11	2	2,769	27,484	2,424
California	4	143		3,579	580,532	
Colorado		2			1,909	
Illinois	78			7,817		
Kansas	7	18		6,872	29,893	
Kentucky	3	6	3	1,383	4,973	911
Louisiana	10	36	3	8,226	45,881	915
New Mexico		1			1,506	
New York	1	2		117	275	
Ohio	20	13	2	700	10,671	1,803
Oklahoma	111	185	1	106,779	512,800	112
Pennsylvania	106	23	2	5,026	10,752	793
Texas	38	115	3	40,441	282,850	1,225
West Virginia	65	41	12	11,781	42,086	15,862
Wyoming	2	7		30,570	12,291	
	446	604	28	226,060	1,563,929	24,045
1929						
Alaska		1			35	
Arkansas	1	11	2	2,895	27,702	2,858
California	2	151		3,238	837,087	
Colorado		3			1,630	
Illinois	78			7,080		
Indiana	1			2		
Kansas	7	19		6,379	29,848	
Kentucky	3	4	2	94	5,219	693
Louisiana	11	34	3	7,835	55,867	1,255
New Mexico		1			1,077	
New York	1	2		32	232	
Ohio	21	10	2	606	8,995	1,565
Oklahoma	111	181		144,852	531,178	
Pennsylvania	110	24	2	5,145	12,652	614
Texas	30	127	2	34,392	384,250	843
West Virginia	64	46	12	11,488	44,733	16,773
Wyoming	2	6		34,899	9,645	
	442	620	25	258,937	1,950,150	24,601

During 1929 natural gasoline was produced in 161 counties in 16 States, and also in Alaska; in 1928, 151 counties were producers. Los Angeles County, Calif., in which are located such prolific producing areas as Long Beach, Santa Fe Springs, Seal Beach, and Huntington Beach, again easily ranked first among the producing counties. The total output of that county in 1929 was 563,698,000 gallons, an increase over 1928 of 61 per cent, 67 per cent of the total production of the State in 1929, and 25 per cent of the output of the entire country. Seminole County, Okla., again ranked second, with an output of 297,299,000 gallons, or 44 per cent of the State's total. Other important producing counties were Ventura, Calif.; Hutchinson, in the Panhandle of Texas; and Osage, Okla.

Natural gasoline produced in the United States in 1929, by States and by counties

State	County	Thousands of gallons	Thousands of dollars
Alaska	Third division	35	4
Arkansas	Ouachita	7,886	582
	Union	25,569	1,837
		33,455	2,419
California	Fresno and Kings	26,266	1,361
	Kern	59,863	6,357
	Los Angeles	563,698	43,368
	Orange	79,496	6,866
	Santa Barbara	18,999	1,273
	Ventura	92,003	7,784
		840,325	67,009
Colorado	Larimer and Las Animas	1,630	113
Illinois	Clark and Cumberland	523	50
	Crawford	2,336	207
	Lawrence	4,221	360
		7,080	617
Indiana	Pike	2	(1)
Kansas	Barber, Montgomery, and Sedgwick	9,108	521
	Butler	3,079	216
	Chautauqua	341	21
	Cowley	6,447	429
	Greenwood	11,139	648
	Sumner	6,113	372
		36,227	2,207
Kentucky	Boyd, Martin, and Wayne	4,643	379
	Clark, Estill, and Menifee	708	58
	Lee and Wolfe	655	49
		6,006	486
Louisiana	Caddo	8,177	576
	Claiborne	12,717	881
	De Soto and Red River	1,373	92
	Morehouse	3,309	181
	Ouachita	9,107	492
	Richland	5,489	279
	Webster	24,785	1,509
		64,957	4,010
New Mexico	Eddy	1,077	71
New York	Allegany	264	22
Ohio	Athens, Hocking, and Meigs	420	32
	Cuyahoga, Lorain, and Medina	326	30
	Fairfield, Licking, and Richland	7,264	584
	Guernsey, Muskingum, and Noble	722	56
	Jefferson and Wayne	1,459	137
	Monroe	424	36
	Washington	551	48
		11,166	923
Oklahoma	Carter	12,812	786
	Creek	78,299	4,944
	Custer, Pontotoc, and Wagoner	1,666	96
	Garfield	11,160	693
	Grady, Harmon, and Stephens	2,772	166
	Hughes	6,663	462
	Kay	24,842	1,555
	Lincoln	8,071	497
	Logan	13,977	680
	Muskogee	957	67
	Noble	11,168	496
	Nowata	1,962	142
	Okfuskee	10,334	658
	Oklahoma	3,620	219
	Okmulgee	9,034	593
	Osage	85,199	6,077
	Pawnee	5,385	345
	Payne	5,351	335
	Pottawatomie	78,153	4,419
	Seminole	297,299	19,026

[1] Less than $500.

Natural gasoline produced in the United States in 1929, by States and by counties—Continued

State	County	Thousands of gallons	Thousands of dollars
Oklahoma—Contd.	Tulsa	5,526	369
	Washington	1,780	141
		676,030	42,766
Pennsylvania	Allegheny	1,602	144
	Armstrong, Beaver, and Lawrence	256	23
	Butler	530	47
	Clarion	507	52
	Crawford	191	18
	Elk and Potter	412	30
	Forest	623	56
	Greene	6,205	537
	McKean	1,479	146
	Venango	3,206	299
	Warren	2,309	235
	Washington	1,091	89
		18,411	1,676
Texas	Anderson, Freestone, and Navarro	5,364	356
	Archer and Clay	4,616	306
	Austin, Caldwell, and Williamson	1,235	76
	Brown	8,586	595
	Carson	20,204	1,367
	Coleman	242	15
	Comanche, Erath, and Throckmorton	866	53
	Cooke and Wilbarger	7,689	391
	Crane, Pecos, and Reagan	31,328	1,943
	Eastland	60,580	3,808
	Gray	63,078	3,872
	Harrison, Panola, and Webb	3,136	161
	Howard, Jones, and Mitchell	2,448	154
	Hutchinson	90,807	5,908
	Moore and Potter	6,290	333
	Palo Pinto	6,844	341
	Shackelford	10,960	695
	Stephens	50,750	3,300
	Wheeler	5,872	328
	Wichita	32,819	2,184
	Young	5,771	375
		419,485	26,561
West Virginia	Brooke and Marshall	1,006	86
	Cabell, Lincoln, and Wayne	2,954	239
	Calhoun, Gilmer, and Wirt	322	28
	Clay and Doddridge	334	28
	Harrison	4,091	379
	Jackson	8,012	607
	Kanawha	27,852	2,437
	Lewis	5,347	472
	Marion	1,886	167
	Monongalia	808	69
	Pleasants	1,081	96
	Ritchie	724	64
	Roane	3,231	262
	Tyler	2,792	240
	Wetzel	12,554	1,111
		72,994	6,285
Wyoming	Carbon, Fremont, Hot Springs, and Niobrara	3,111	191
	Natrona	41,433	3,050
		44,544	3,241
United States		2,233,688	158,410

STOCKS OF NATURAL GASOLINE AT PLANTS

Stocks of natural gasoline held by plant operators on December 31, 1929, amounted to 26,139,000 gallons, a decline of slightly more than 1,000,000 gallons from the previous year. In 1929, as in 1928, Oklahoma showed the largest decline in natural-gasoline stocks. Stocks of blended motor fuel held by natural-gasoline plant operators fell off materially during the year, amounting to only 695,000 gallons on December 31, 1929.

Stocks at natural gasoline plants in the United States, January 1 and December 31, 1929, in thousands of gallons

State	Raw natural gasoline		Blended motor fuel	
	Jan. 1	Dec. 31	Jan. 1	Dec. 31
Alaska	1	3	12	12
Arkansas	324	335	1	57
California	1,576	1,949	8	
Colorado	12	1		
Illinois	197	188		
Kansas	981	591	18	7
Kentucky	119	116	7	9
Lousiana	1,190	1,008	21	7
New Mexico	147	27		
New York	34	5	24	21
Ohio	193	217	21	5
Oklahoma	11,137	9,861	747	287
Pennsylvania	802	773	143	103
Texas	8,387	9,098	156	145
West Virginia	1,565	1,463	66	42
Wyoming	496	504		
	27,161	26,139	1,224	695

NATURAL GASOLINE TURNED INTO PIPE LINES

The transportation of natural gasoline by pipe line was stimulated during 1929 by a rapid growth in the art of welding. In California, construction has been finished, or is under way, on several lines to transport natural gasoline, light crude oil, or both. One such line was recently completed from the Kettleman Hills field to tidewater at Avila, a distance of 88 miles. This line was built to transport natural gasoline but eventually may be used to carry crude oil also.

According to monthly reports, 99,834,000 gallons of natural gasoline was mixed with crude oil and turned into pipe lines in California in 1929; east of California this practice continued to be of minor importance, only 13,700,000 gallons being turned into pipe lines. The total for the country was 113,534,000 gallons in 1929, compared with 106,616,000 gallons in 1928. That no greater increase is indicated in the figures is due to the fact that one company transported large quantities of natural gasoline unmixed with crude oil through a pipe line, but reported it as natural gasoline blended at refineries.

Natural gasoline turned into crude-petroleum pipe lines in the United States, 1923–1929, by States, in thousands of gallons

State	1923	1924	1925	1926	1927	1928	1929
Alaska			20	18	15	22	32
Arkansas				2,188			
California	50,398	87,135	107,771	138,474	141,500	80,000	99,834
Colorado							222
Illinois	26			12	3	4	
Kansas				243	3,172	5,050	2,471
Kentucky				1			
Louisiana	3,049	373	136		72		
Oklahoma	15,418	1,640	2,065	8,472	5,701	8,093	4,270
Pennsylvania	252						2
Texas	3,529	347	171	91	1,658	13,361	6,659
West Virginia	25				10		
Wyoming	1,838			47	548	86	44
	74,535	89,495	110,163	149,546	152,679	106,616	113,534

NATURAL GAS TREATED

During 1929 a total of 1,917,693,000,000 cubic feet of natural gas was produced and delivered to consumers, a gain of 22 per cent over 1928, compared with a gain of 8 per cent in 1928 over 1927 and an average annual gain of 10 per cent for the past 10 years. Deliveries of natural gas to Canada and Mexico increased from 160,000,000 cubic feet in 1928 to 242,000,000 cubic feet in 1929. Deducting the gas piped out of the country in 1929 from the total production gives 1,917,451,000,000 cubic feet as the total consumption within the country during the year. The quantity of gas treated for the recovery of natural gasoline in 1929 was 1,959,294,000,000 cubic feet, or 102 per cent of the total consumed. This is the first year in which the quantity of gas treated has exceeded the quantity consumed. The excess is due to the fact that large quantities of gas from the flush fields of California and from wells in the Panhandle of Texas were treated for the recovery of natural gasoline, and the residue gas, for the want of a market and for other reasons, was blown off into the air.

Natural gas produced and consumed in the United States and portion treated for recovery of natural gasoline, 1920–1929

	Produced and delivered to consumers (millions of cubic feet)	Consumed (millions of cubic feet)	Treated for recovery of gasoline (millions of cubic feet)	Ratio (percentage) of natural gas treated for gasoline—	
				To quantity produced and delivered to consumers	To quantity consumed
1920	798,210		496,431	62	
1921	662,052		465,097	70	
1922	762,546		545,139	71	
1923	[1] 1,006,976	1,006,967	875,711	87	87
1924	[2] 1,141,521	1,141,482	1,016,276	89	89
1925	[3] 1,188,571	1,188,439	1,040,390	88	88
1926	[4] 1,313,019	1,312,853	1,206,300	92	92
1927	[5] 1,445,428	1,445,244	1,341,248	93	93
1928	[6] 1,568,139	1,567,979	1,473,434	94	94
1929:					
Arkansas	19,928	39,758	11,644	58	29
California [7]	342,214	342,214	617,648	180	180
Colorado	2,787	14,362	1,880	67	13
Illinois	2,983	3,139	2,760	93	88
Kansas [8]	38,469	75,476	47,565	124	63
Kentucky [9]	27,588	19,444	23,479	85	121
Louisiana	261,138	200,777	153,370	59	76
New Mexico	3,054	1,021	555	18	54
New York	[10] 8,387	18,192	598	7	3
Ohio	57,936	126,631	43,901	76	35
Oklahoma	357,893	329,295	314,649	88	96
Pennsylvania	101,951	122,876	50,789	50	41
Texas [7] [11]	[12] 464,928	465,526	479,543	103	103
West Virginia [8] [9]	167,333	73,856	177,606	106	240
Wyoming	44,648	43,500	33,278	75	77
Other	16,456	41,384	29	----------	----------
	[13] 1,917,693	1,917,451	1,959,294	102	102

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[1] Includes 9,000,000 cubic feet piped to Mexico.

[2] Includes 39,000,000 cubic feet piped to Canada and Mexico.

[3] Includes 132,000,000 cubic feet piped to Canada and Mexico.

[4] Includes 166,000,000 cubic feet piped to Canada and Mexico.

[5] Includes 184,000,000 cubic feet piped to Canada and Mexico.

[6] Includes 160,000,000 cubic feet piped to Canada and Mexico.

[7] Large quantities of gas both before and after the recovery of gasoline were blown into the air or unaccounted for.

[8] Quantities of natural gas were piped from other States and treated for gasoline recovery.

[9] Natural gas was treated for gasoline recovery and consumed in other States.

[10] Includes 103,000,000 cubic feet piped to Canada.

[11] Quantities of natural gas were piped from other States, treated for gasoline recovery, and residue gas returned to States in which produced.

[12] Includes 139,000,000 cubic feet piped to Mexico.

[13] Includes 242,000,000 cubic feet piped to Canada and Mexico.

LIQUEFIED PETROLEUM GASES

The following paragraphs have been abstracted from a press statement by Swanson.[2]

The need by petroleum refiners for more stable grades of natural gasoline necessitated the removal of the more volatile fractions of the raw casing-head gasoline. These fractions were removed originally by "weathering," in which the major portion of the volatile fractions was lost; in recent years, however, the use of fractionating columns has permitted their recovery and utilization for domestic and industrial purposes. These lighter hydrocarbons occupy the intermediate zone between the so-called permanent gases and liquids. They remain in liquid form when under pressure but are gases at atmospheric pressure and normal temperatures. Consequently, they may be stored and transported as liquids under pressure in special cars, tanks, wagons, and cylinders and used as gases at atmospheric pressure. Propane and the butanes form the compounds in the liquefied petroleum gases now definitely established, but pentane, a liquid at average temperatures, also is marketed for similar purposes.

The production of Pintsch gas, a compressed gas made by cracking oil and used principally as an illuminant; the manufacture of Blaugas, a liquefied petroleum gas made from gas oil; and the extraction and liquefaction on a relatively small scale of some of the lighter fractions of casing-head gasoline constitute a background, extending over approximately half a century, for the recent developments in the commercial manufacture and sale of liquefied petroleum gases. At present the natural gasoline extracted from natural gas is the principal source of the lighter hydrocarbons suitable for liquefied petroleum-gas manufacture, although the refinery gases resulting from various oil-distillation processes constitute a potential source.

The record of the production of liquefied petroleum gases may be extended as far back as 1912, when Blaugas was established as a commercial product; as such a record would in part indicate the operations of individual companies the record of marketed production is extended only through 1922, the period during which three or more companies were annually engaged. The annual marketed production of liquefied petroleum gases is given in the following table.

Marketed production of liquefied petroleum gases, 1922–1929

Year	Gallons	Year	Gallons
1922	222, 641	1926	465, 085
1923	276, 863	1927	1, 091, 005
1924	376, 488	1928	4, 522, 899
1925	403, 674	1929	9, 925, 698

The use of liquefied petroleum gas as a domestic fuel in territories not served by gas mains was the first important development in the use of the products. Propane, self-vaporizing at temperatures above minus 44° F. and with a heating value of approximately 2,500 B. t. u. per cubic foot, is used most widely for this purpose. In the 2-drum system of service two cylinders of fuel are installed in a special cabinet outside the customer's residence, and the gas is piped through a regulator to the appliances. Upon the exhaustion of one cylinder the second is turned on and the empty cylinder is returned to the bulk station to be recharged. In the 1-drum service a single cylinder is furnished the customer. This cylinder is periodically charged from a service truck, the cylinder being weighed before and after charging, and the customer is billed for the actual amount of fuel used. Cylinders are of several different sizes—25, 35, 40, 50, 60, 88, 100, and 150 pounds—but the more common sizes are 60 and 100 pounds.

According to the reports submitted to the Bureau of Mines, the number of customers served with "bottled gas" increased from about 20,000 in 1928 to approximately 55,000 in 1929. The major portion is consumed in the North Atlantic and North Central States, California, and the Southern States of the Atlantic seaboard. The price per pound to the consumer in the Pacific coast territory ranged from 9.5 to 10.5 cents, and east of the Rocky Mountains it ranged from 11.3 to 14.5 cents, according to the distance of the consumer from the source of supply.

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[2] Swanson, E. B., Liquefied Petroleum Gases: Press statement, Bureau of Mines, June 20, 1930.

Special attention has been given to the utilization of liquified petroleum gases in conjunction with the gas industry to replace gas oil in carbureting gases of relatively low thermal value to the required calorific standard, as a base material for manufactured gas, for the recarburetion of gases to offset the loss of thermal value in high-pressure transmission system, to meet peak load conditions, as a protection against interruptions in service, and as a source of gas supply to communities that are not large enough to warrant the installation of manufactured-gas plants or the extension of distribution systems from near-by centers. Propane, butane, and pentane have been used for these purposes.

Liquified petroleum gases also have been applied to a number of industrial purposes. Several industrial plants have installed butane storage equipment as a stand-by to guard against the interruption of their normal fuel supply. Propane is being used as a fuel to heat the absorbers in iceless automatic refrigeration cars, and its use in a somewhat similar way for cooling railroad passenger cars has been suggested. In the metal and allied industries liquefied gases are being used for heat treating, hardening, annealing, gas carburizing, enameling, core baking, metal cutting, forging, and similar operations. In commercial laundries these gases are used for operating collar and cuff pressing machines, mangles, hand irons, and washing machines, and in the food industries they have been applied to the canning of milk, fruits, and vegetables and to the roasting of coffee and peanuts.

In school, industrial, and hospital laboratories propane is being used for operating burners, hot plates, and sterilizers and in industrial plants, for heating soldering irons, bench furnaces, for heat treating small tools, and for the melting of soft metals, such as copper, brass, bronze, and lead. Other industrial applications include its use in glass annealing and the burning of ceramic ware; for singeing, drying, and heating calendar rolls in textile mills; for heating type-melting pots in printing plants; in glass blowing and working; in carbonizing radio-tube plates; in lead burning and the production of distilled water at battery service stations; as a refrigerant in gas-fired refrigerators; for pilot lights on oil and pulverized-coal burners; for paint burning; for incubator heating and egg candling; in preheating for welding; and in the operation of heavy-duty cooking equipment in hotels, clubs, restaurants, road stands, dining cars, and boats. The industrial application of these liquefied gases is being extended continually through experimental studies.

NATURAL GASOLINE UTILIZED BY REFINERIES

The refiners are by far the largest consumers of natural gasoline and in 1929 utilized 93 per cent of the total distribution. The refiners in 1929 used 1,851,360,000 gallons (44,080,000 barrels) of natural gasoline in blending, in addition to 99,834,000 gallons (2,377,000 barrels) turned into pipe lines in California (see p. 308). With respect to quantity the California district easily ranked first in the utilization of natural gasoline, but was outranked by the Louisiana Gulf coast in point of per cent of total gasoline output. Almost a fourth of the motor fuel produced in the Louisiana Gulf coast area is natural gasoline, the result primarily of the operations of one company which blends large quantities of natural gasoline in the manufacture of export gasoline.

Natural gasoline blended at refineries in the United States in 1929, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	The year
East coast	9,156	14,280	7,434	12,096	9,702	3,570	3,822	9,828	5,544	6,888	8,148	13,398	103,866
Appalachian	3,192	2,562	2,100	1,470	1,302	1,932	2,016	1,932	2,142	2,310	3,066	2,940	26,964
Indiana, Illinois, Kentucky, etc	7,896	6,006	6,762	6,846	7,392	7,980	9,156	8,820	8,442	15,204	14,070	12,138	110,712
Oklahoma, Kansas, and Missouri	12,600	10,668	11,802	12,180	13,188	14,700	16,716	17,934	16,254	18,060	17,094	17,220	178,416
Texas:													
Gulf coast	24,906	23,940	30,702	26,880	25,326	22,260	21,882	25,242	34,104	38,178	25,074	25,074	323,568
Rest of State	4,326	4,242	5,334	5,712	6,636	6,552	6,636	8,694	9,072	9,828	9,114	9,744	85,890
Total Texas	29,232	28,182	36,036	32,592	31,962	28,812	28,518	33,936	43,176	48,006	34,188	34,818	409,458
Louisiana-Arkansas:													
Louisiana Gulf coast	15,666	14,406	23,184	19,320	21,210	18,186	16,968	18,186	16,380	20,034	16,212	18,480	218,232
Northern Louisiana and Arkansas	4,284	3,990	4,872	4,410	5,292	5,250	5,964	6,132	6,468	6,426	6,636	4,746	64,470
Total Louisiana and Arkansas	19,950	18,396	28,056	23,730	26,502	23,436	22,932	24,318	22,848	26,460	22,848	23,226	282,702
Rocky Mountain	3,990	4,410	5,418	5,334	5,670	5,460	5,460	5,460	5,796	5,586	4,914	5,166	62,664
California	47,082	43,554	61,194	51,366	49,434	52,374	59,808	60,732	62,328	71,610	52,248	64,848	676,578
Grand total	133,098	128,058	158,802	145,614	145,152	138,264	148,428	162,960	166,530	194,124	156,576	173,754	1,851,360

BLENDING AT THE PLANTS

At one time natural-gasoline manufacturers considered it profitable to buy naphtha from refiners and do their own blending. However, the increasing difficulty experienced in obtaining naphtha or other suitable oils for blending at prices sufficiently below the selling price for finished motor fuel has reduced blending at producers' plants to a low point. For example, during 1929 the quantity of natural gasoline used in motor blends at natural-gasoline plants (exculsive of California) amounted to 27,569,000 gallons, or only 2 per cent of the production. This decline in blending by manufacturers has tended to make them more and more dependent upon refineries as an outlet for their product.

The 27,569,000 gallons of natural gasoline used in blends in 1929 was mixed with 32,333,000 gallons of naphtha. These figures indicate a proportion of slightly more than 1:1 in favor of naphtha; the proportion of naphtha is a decline from 1928.

Natural gasoline and naphtha used in motor blends at natural-gasoline plants in the United States, 1928 and 1929, in thousands of gallons

	Natural gasoline		Naphtha	
	1928	1929	1928	1929
Appalachian	1, 541	1, 028	2, 171	1, 348
Kentucky and Illinois	42	7	54	15
Oklahoma and Kansas	19, 591	18, 822	24, 171	20, 013
Texas	3, 504	4, 651	5, 902	6, 988
Louisiana and Arkansas	2, 009	3, 061	1, 968	3, 969
Rocky Mountain				
California	(1)	(1)	(1)	(1)
	[1] 26, 687	[1] 27, 569	[1] 34, 266	[1] 32, 333

[1] Figures for California not available.

MONTHLY STATISTICS OF NATURAL GASOLINE

The preliminary figure for the total production of natural gasoline in 1929, as compiled from replies to monthly inquiries and shown in the following table, was 2,195,400,000 gallons. This figure is approximately 38,000,000 gallons, or 2 per cent, below the final figure; the chief reason for the difference is the fact that the annual canvass reaches a number of small plants not covered by the monthly inquiries.

Production increased steadily in the spring of 1929, showed little change during the summer months, rose rapidly in September and October, but fell back in November and December. The production in October, 1929, 206,300,000 gallons, established a record, which up to September, 1930, has not been approached. The increased output in September and October resulted primarily from increased activity in the Panhandle of Texas and in the Santa Fe Springs field of California.

Summary of monthly (preliminary) natural-gasoline and motor-fuel statistics in the United States in 1929, by months, in millions of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	The year
Natural gasoline:													
Production by fields—													
Appalachian	11.4	10.9	9.3	8.2	8.0	6.3	5.9	6.3	6.7	8.9	9.4	10.3	101.6
Kentucky, Illinois, etc	1.4	1.2	1.2	1.2	1.2	.9	.9	.9	.9	1.3	1.3	1.4	13.8
Oklahoma—													
Seminole	26.4	23.4	28.2	29.1	30.3	30.9	31.0	30.9	31.7	30.4	27.4	25.2	344.9
Osage County	7.1	6.0	7.8	7.3	6.7	6.4	6.6	7.0	6.9	7.6	7.8	7.3	84.5
Rest of State	21.6	18.1	21.0	20.6	21.6	20.1	20.0	19.6	20.6	21.4	20.4	22.1	247.1
Total Oklahoma	55.1	47.5	57.0	57.0	58.6	57.4	57.6	57.5	59.2	59.4	55.6	54.6	676.5
Kansas	3.1	2.8	2.9	3.0	3.0	2.6	2.5	2.5	2.7	2.8	3.1	2.8	33.8
Texas—													
Panhandle	12.2	11.5	13.3	13.3	13.4	12.8	13.5	15.8	17.8	19.3	20.8	20.1	183.8
North Texas	3.9	3.9	4.6	4.2	4.2	3.9	3.9	3.7	3.8	3.9	4.2	4.2	48.4
West central	13.5	12.1	12.8	12.6	12.9	12.2	12.1	12.2	12.2	13.8	12.6	12.3	151.3
Rest of State	1.6	2.3	3.2	3.3	3.6	3.6	3.7	3.6	3.5	3.7	3.3	3.4	38.8
Total Texas	31.2	29.8	33.9	33.4	34.1	32.5	33.2	35.3	37.3	40.7	40.9	40.0	422.3
Louisiana	5.1	4.9	5.1	4.7	4.9	4.8	4.9	5.1	5.2	6.3	6.1	6.3	63.4
Arkansas	2.7	2.4	2.7	2.7	2.7	2.6	2.7	2.8	2.8	2.9	2.7	2.6	32.3
Rocky Mountain	3.3	3.2	3.7	4.0	4.3	4.1	4.0	4.2	4.3	4.4	3.9	4.1	47.5
California—													
Long Beach	18.4	18.4	20.9	20.4	19.5	19.2	20.5	20.2	19.3	20.1	15.8	15.1	227.8
Ventura Avenue	6.0	5.5	6.3	6.2	6.5	6.8	6.7	7.0	6.8	7.1	6.3	5.4	76.6
Seal Beach	2.7	2.7	3.4	3.8	3.7	3.5	3.9	3.9	2.8	4.3	3.3	3.3	41.3
Huntington Beach	3.8	3.4	3.0	3.4	3.4	3.4	3.5	3.6	3.4	3.7	3.6	3.7	41.9
Santa Fe Springs	9.0	11.0	16.4	15.5	16.6	19.3	22.7	23.4	24.7	26.2	18.3	19.2	222.3
Rest of State	14.1	13.2	15.8	15.6	15.9	15.1	16.5	16.6	16.0	18.2	18.9	18.4	194.3
Total California	54.0	54.2	65.8	64.9	65.6	67.3	73.8	74.7	73.0	79.6	66.2	65.1	804.2
Total United States	167.3	156.9	181.6	179.1	182.4	178.5	185.5	189.3	192.1	206.3	189.2	187.2	2,195.4
Daily average	5.4	5.6	5.9	6.0	5.9	6.0	6.0	6.1	6.4	6.7	6.3	6.0	6.0
Indicated deliveries	161.7	153.5	174.3	171.9	173.0	179.9	194.0	200.3	201.8	213.5	188.2	183.4	2,195.5
Stocks at end of period	31.1	34.5	41.8	49.0	58.4	57.0	48.5	37.5	27.8	20.6	21.6	25.4	25.4
Blending at plants:													
Natural gasoline used [1]	2.3	1.8	2.0	2.5	2.7	2.6	2.9	2.7	2.5	2.0	1.9	1.8	27.7
Naphtha used [1]	2.6	2.2	2.4	3.2	3.4	3.0	3.0	2.9	2.7	2.4	2.5	2.0	32.3
Stocks of blends at end of period	.9	1.0	.8	1.0	1.0	1.1	1.1	1.0	1.0	.9	.7	.7	.7

Indicated output of motor fuel:													
Gasoline produced at refineries	1,440.6	1,315.1	1,454.3	1,455.3	1,524.2	1,495.5	1,588.2	1,620.8	1,564.2	1,675.1	1,569.1	1,570.9	18,273.3
Natural gasoline—													
Blended at plants[1]	2.3	1.8	2.0	2.5	2.7	2.6	2.9	2.7	2.5	2.0	1.9	1.8	27.7
Sold to jobbers (estimate)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	25.2
Benzol produced[2]	10.5	9.8	11.1	10.7	11.2	10.8	11.1	11.1	10.6	11.1	10.3	10.0	128.3
Total United States	1,455.5	1,328.8	1,469.5	1,470.6	1,540.2	1,511.0	1,604.3	1,636.7	1,579.4	1,690.3	1,583.4	1,584.8	18,454.5
Daily average	47.0	47.5	47.4	49.0	49.7	50.4	51.8	52.8	52.6	54.5	52.8	51.1	50.6

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[1] Exclusive of California.

[2] Estimated with production of by-product coke as basis.

SPOT PRICES OF NATURAL GASOLINE

The most noteworthy characteristic of the weekly record of spot prices of grade A natural gasoline in Oklahoma in 1929 was the absence of extreme fluctuations. The price over the entire year did not rise above 8 cents per gallon and never quite fell to as low as 6 cents. In contrast, during 1928, the price declined to a low of 4.13 cents (April 3), then rose to a high of 10.75 cents (August 14) in a little more than four months. The year 1929 opened with prices at the high point—8 cents per gallon—and for the first four months of the year only minor fluctuations occurred. Over the next four months the history of 1927 was repeated; that is, prices weakened although this was the period of highest gasoline consumption.

Spot price of Oklahoma natural gasoline, grade A, on specified dates, with monthly and yearly averages, 1928 and 1929, in cents per gallon

[Oil and Gas Journal]

Date	Cents	Date	Cents
1928		1929	
Jan. 3	5.25	Jan. 1	8
Jan. 10	5.25	Jan. 8	7.25
Jan. 17	5.38	Jan. 15	6.75
Jan. 24	5.5	Jan. 22	7.25
Jan. 31	5.38	Jan. 29	7.75
Average	5.34	Average	7.35
Feb. 7	5.25	Feb. 5	7.25
Feb. 14	5.5	Feb. 12	7.38
Feb. 21	5.5	Feb. 19	7.75
Feb. 28	5.5	Feb. 26	7.75
Average	5.41	Average	7.53
Mar. 6	5	Mar. 5	6.88
Mar. 13	5	Mar. 12	7.75
Mar. 20	4.75	Mar. 19	7.5
Mar. 27	4.5	Mar. 26	8
Average	4.94	Average	7.32
Apr. 3	4.13	Apr. 2	8
Apr. 10	4.75	Apr. 9	8
Apr. 17	5.75	Apr. 16	8
Apr. 24	6.25	Apr. 23	7.88
Average	5.17	Apr. 30	7.75
May 1	6	Average	7.96
May 8	5.5	May 7	7.63
May 15	6.38	May 14	7.25
May 22	6.38	May 21	6.75
May 29	5.5	May 28	7.75
Average	6.01	Average	7.38
June 5	6	June 4	7.5
June 12	6	June 11	7.5
June 19	5.75	June 18	7.63
June 26	6.38	June 25	7.25
Average	5.94	Average	7.51
July 3	6.88	July 2	7
July 10	7.38	July 9	7
July 17	8.5	July 16	6.13
July 24	9.5	July 23	6.25
July 31	10.13	July 30	6.25
Average	8.02	Average	6.59
Aug. 7	10.5	Aug. 6	6.25
Aug. 14	10.75	Aug. 13	6.38
Aug. 21	10.75	Aug. 20	6.63
Aug. 28	10.75	Aug. 27	6.75
Average	10.57	Average	6.45
Sept. 4	9.75	Sept. 3	6.5
Sept. 11	8.75	Sept. 10	6.5
Sept. 18	9.25	Sept. 17	6.75
Sept. 25	10	Sept. 24	6.75
Average	9.55	Average	6.63
Oct. 2	9.5	Oct. 1	6.5
Oct. 9	10.25	Oct. 8	6.5
Oct. 16	9.88	Oct. 15	6.5
Oct. 23	9.63	Oct. 22	6.75
Oct. 30	10.13	Oct. 29	6.75
Average	9.84	Average	6.58

Spot price of Oklahoma natural gasoline, grade A, on specified dates, with monthly and yearly averages, 1928 and 1929, in cents per gallon—Continued

Date	Cents	Date	Cents
1928		1929	
Nov. 6	9.63	Nov. 5	6.63
Nov. 13	9.38	Nov. 12	6.5
Nov. 20	8.75	Nov. 19	6.75
Nov. 27	9.13	Nov. 26	6.75
Average	9.38	Average	6.66
Dec. 4	9	Dec. 3	6.88
Dec. 11	9	Dec. 10	6.75
Dec. 18	8.75	Dec. 17	6.63
Dec. 26	8.38	Dec. 24	6.5
Average	8.83	Dec. 31	6.25
Average for the year	7.43	Average	6.68
		Average for the year	7.05

SURVEY OF NATURAL-GASOLINE PLANTS

On January 1, 1930, there were 1,035 natural-gasoline plants in continental United States, with a total daily capacity of 10,516,000 gallons. The preceding similar survey, that of January 1, 1928, showed a total of 1,155 plants with a total daily capacity of 8,048,000 gallons. Thus in two years the number of plants decreased by 120, or 10 per cent, but the total daily capacity increased by 2,468,000 gallons, or 31 per cent. This increase in capacity corresponds roughly to the increase in production over the same period.

More than half the increase in total daily capacity was registered in California, where the development of flush oil production having a comparatively high gas-oil ratio in such fields as Santa Fe Springs led to construction of new plants and material enlargement of others.

Of the total plants on January 1, 1930, 999 were operating and 36 were shut down, compared with 1,060 operating and 95 shut down on January 1, 1928. These figures indicate a tendency to dismantle plants as soon as they become obsolete or unprofitable. The daily capacity of the plants operating on January 1, 1930, amounted to 10,278,000 gallons, or 98 per cent of the total daily capacity, leaving only 238,000 gallons, or 2 per cent of the total, as the daily capacity of the plants that were shut down. In contrast, the refining industry usually has 5 per cent of its total capacity idle. The difference is due to the relative ease with which the refiner can secure a crude-oil supply as compared with the difficulty the natural-gasoline manufacturer has in reestablishing his gas connections.

During the year 1929 the total daily capacity of the operating plants was 9,647,000 gallons, whereas the total daily production was 6,120,000 gallons. In other words, the plants operated during 1929 at 63 per cent of their capacity.

Although more than 60 plants were dismantled in Oklahoma during 1928 and 1929, the State continued to rank first in total number. California was second in number of plants on January 1, 1930, with 165, and was one of the few States that showed a gain between January 1, 1928, and January 1, 1930. California was the leading State in total daily capacity, with 3,658,000 gallons; Oklahoma was second, with 3,085,000 gallons. The disparity between the average sizes of plants in various sections of the country was more pronounced in 1930 than at any time since these surveys were begun; for example, the average daily capacity per plant in Pennsylvania on January 1, 1930, was less than 1,000 gallons, whereas in California it was more than 20,000 gallons.

The absorption method of extracting natural gasoline made a further gain in relative importance during 1928 and 1929 at the expense of the compression and charcoal methods. The daily capacity of the plants using the absorption method increased from 5,476,000 gallons, or 68 per cent of the total capacity, on January 1, 1928, to 7,956,000 gallons, or 76 per cent of the total, on January 1, 1930. The charcoal method of producing natural gasoline, the most recent development in equipment for manufacturing natural gasoline, declined in favor during 1928 and 1929; the total number of plants fell from 27 on January 1, 1928, to 23 on January 1, 1930, and the total daily capacity from 214,000 to 186,000 gallons.

Biennial survey of natural-gasoline plants in the United States, January 1, 1928 and 1930, by States[1]

State	Number							Daily capacity (thousands of gallons)						
	Operating	Shutdown	Total	By processes				Operating	Shutdown	Total	By processes			
				Absorption	Compression	Combination	Charcoal				Absorption	Compression	Combination	Charcoal
JANUARY 1, 1928														
Arkansas	14	4	18	11	3	3	1	124	9	133	89	4	35	5
California	141	18	159	109	4	45	1	2,099	83	2,182	1,641	24	460	57
Colorado	1		1	1				1		1	1			
Illinois	76	2	78		78			57	1	58		58		
Kansas	23		23	14	8	1		164		164	113	41	10	
Kentucky	11	1	12	5	4		3	57	1	58	46	7		5
Louisiana	45	3	48	30	11	5	2	262	16	278	214	36	21	7
New Mexico	1		1	1				10		10	10			
New York	3	1	4	2	1	1		2	1	3	2	1	(2)	
Ohio	33	4	37	15	20		2	56	3	59	47	4		8
Oklahoma	302	29	331	165	137	29		2,663	96	2,759	1,629	769	361	
Pennsylvania	138	15	153	20	[3]121	8	4	122	9	131	55	[3]33	31	12
Texas	146	11	157	105	41	8	3	1,624	53	1,677	1,331	306	20	20
West Virginia	117	7	124	42	66	5	11	384	22	406	244	40	22	100
Wyoming	9		9	6	3			129		129	54	75		
	[1]1,060	95	[1]1,155	[1]526	[3]497	105	27	7,754	294	8,048	[1]5,476	[3]1,398	960	214
JANUARY 1, 1930														
Arkansas	14		14	8	1	3	2	130		130	82	8	30	11
California	144	21	165	106	2	56	1	3,452	206	3,658	2,950	26	641	40
Colorado	2		2	2				18		18	18			
Illinois	75	1	76		76			50	(2)	50		50		
Indiana	1		1		1			(2)		(2)		(2)		
Kansas	23		23	16	7			190		190	162	28		
Kentucky	9	1	10	5	4		1	46	1	47	41	4		2
Louisiana	47	1	48	30	11	4	3	396	1	397	329	38	21	9
New Mexico	1		1	1				10		10	10			
New York	2	1	3	2	1			1	1	2	1	1		
Ohio	30		30	8	20		2	61		61	51	3		7
Oklahoma	264	4	268	145	93	30		3,064	21	3,085	2,174	500	411	
Pennsylvania	126	5	131	21	[3]104	4	2	122	6	128	70	[3]33	19	6
Texas	143	1	144	102	30	11	1	2,218	2	2,220	1,793	249	174	4
West Virginia	110	1	111	34	59	7	11	393	(2)	393	236	35	15	107
Wyoming	8		8	6	2			127		127	39	88		
	[1]999	36	[1]1,035	[1]486	[3]411	115	23	10,278	238	10,516	[1]7,956	[3]1,063	1,311	186

[1] Exclusive of Alaska which has one absorption plant operating with a daily capacity of 130 gallons.

[2] Less than 500 gallons.

[3] Vacuum and gas pumps in Pennsylvania counted under compression.

NATURAL GAS [1]

By G. R. Hopkins and H. Backus

SUMMARY

The steady growth that has characterized the natural-gas industry of the United States for a number of years was more than maintained in 1929, when the total production amounted to 1,917,693,000,000 cubic feet, an increase of 22 per cent over 1928, compared with an increase of 8 per cent in 1928 over 1927 and with an average annual increase of 10 per cent for the past 10 years. Deliveries of natural gas to Canada and Mexico in 1929 amounted to 242,000,000 cubic feet. Deducting the gas piped out of the country in 1929 from the total production gives 1,917,451,000,000 cubic feet as the total consumption within the country during the year. Of this total 19 per cent was consumed for domestic purposes and 81 per cent for industrial purposes, a gain over 1928 in the relative importance of industrial consumption. The quantity of gas treated for the recovery of natural gasoline in 1929 amounted to 1,959,294,000,000 cubic feet, or 102 per cent of the total quantity produced and delivered to consumers. In 1929, for the first time, the quantity of gas treated exceeded the quantity consumed, owing primarily to the fact that large quantities of gas from the flush fields of California and from wells in the Panhandle of Texas were treated for the recovery of natural gasoline, and the residue gas, for want of a market and for other reasons, was blown into the air. There were 5,116,000 domestic consumers in 1929, compared with 4,344,000 in 1928, a gain of 18 per cent. This increase reflects the material expansion in distributing facilities which took place during the year. The average price of natural gas at the wells declined from 8.9 cents per thousand cubic feet in 1928 to 8.2 cents in 1929, largely because of the material increase in the quantity of low-priced gas burned for carbon black. The gas burned for domestic purposes in the United States had an average value of 62 cents per thousand cubic feet in both 1929 and 1928, compared with 60.8 cents in 1927. The completion of several large lines traversing a number of States and the trend toward the use of larger-size pipe were reflected in the interstate deliveries of natural gas, which rose to the new high level of 325,021,000,000 cubic feet in 1929.

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[1] Work on manuscript completed October, 1930.

Summary of statistics for natural gas in the United States, 1925–1929

	1925	1926	1927	1928	1929
Natural gas consumed:					
Domestic ... millions of cubic feet	272,146	289,175	296,036	320,877	359,853
Industrial[1]—					
Carbon black ... do	140 366	130,321	144,087	175,137	261,107
Field ... do	423,524	478,188	549,455	573,698	705,083
Electric public-utility power plant fuel ... millions of cubic feet	46,521	53,207	62,919	77,326	112,707
Refinery fuel ... do	87,842	121,449	123,395	114,950	103,729
Other industrial ... do	218,040	240,513	269,352	305,991	374,972
	1,188,439	1.312,853	1,445,244	1,567,979	1,917,451
Domestic ... per cent	23	22	20	20	19
Industrial ... do	77	78	80	80	81
Treated for natural gasoline:					
Millions of cubic feet	1,040,390	1,206,300	1,341,248	1,473,434	1,959,294
Per cent of total consumption	88	92	93	94	102
Domestic consumers ... thousands	3,508	3,731	3,984	4,344	5,116
Value of natural gas at wells:					
Total ... thousands of dollars	112,047	124,693	127,468	139,898	157,596
Average per M cubic feet ... cents	9.4	9.5	8.8	8.9	8.2
Value of natural gas at points of consumption:					
Total ... thousands of dollars	265,184	300,055	317,803	363,631	413,153
Domestic ... do	152,494	168,870	180,018	198,808	223,172
Industrial ... do	112,690	131,185	137,785	164,823	189,981
Average per M cubic feet—					
Domestic ... cents	56.0	58.4	60.8	62.0	62.0
Industrial ... do	12.3	12.8	12.0	13.2	12.2
Domestic and industrial ... do	22.3	22.9	22.0	23.2	21.5
Natural gasoline:					
Quantity ... thousands of gallons	1,127,470	1.363,090	1,641,144	1,814,034	2,233,688
Value at plants—					
Total ... thousands of dollars	120.383	136,412	118,688	138,944	158,410
Average per gallon ... cents	10.7	10.0	7.2	7.7	7.1
Carbon black:					
Quantity ... thousands of pounds	177,417	180,576	198,429	248,790	366,442
Value at plants—					
Total ... thousands of dollars	9,640	9,939	10,955	13,782	18,720
Average per pound ... cents	5.4	5.5	5.5	5.5	5.1

[1] Figures on consumption by public utilities from U. S. Geological Survey; others partly estimated.

PRODUCTION AND CONSUMPTION

The total production of natural gas in the United States during 1929 amounted to 1,917,693,000,000 cubic feet, an increase over 1928 of 349,554,000,000 cubic feet, or 22 per cent. This total does not include the large but decreasing quantity of natural gas blown into the air incident to the production of oil in flush fields. Deliveries of natural gas to Canada increased from 84,000,000 cubic feet in 1928 to 103,000,000 cubic feet in 1929; deliveries to Mexico increased from 76,000,000 cubic feet to 139,000,000 cubic feet over the same period.

Texas, by virtue of a 54 per cent gain in output, became for the first time the leading natural-gas producing State. Production in Oklahoma increased materially in 1929, but the gain in California was greater; the two States produced approximately the same total during the year. Louisiana and West Virginia, which ranked fourth and fifth, respectively, each reported increase in output in 1929 and ranked well ahead of Pennsylvania, the State in sixth place. A number of States reported declines in natural-gas output in 1929; the outstanding examples were Wyoming and Kansas. Some of the smaller producing States—notably Kentucky, Montana, Michigan, and New Mexico—made material gains in output in 1929. The three leading natural-gas producing States—Texas, Oklahoma, and California—produced 61 per cent of the total output in 1929, compared with 55 per cent in 1928. In the related industries—crude-oil production and natural-gasoline production—they produced 84 and 87 per cent, respectively, of the total in 1929.

Little natural gas is stored; hence the natural-gas consumption in a State is equal to the production in that State plus or minus the quantities piped in or out. Texas ranked first in both production and consumption of natural gas in 1929, and California, which neither receives gas from nor delivers gas to other States, ranked ahead of Oklahoma in consumption; Ohio, which is well down the list with respect to production, ranked fifth in consumption.

The total estimated value at wells of the natural gas produced in 1929 amounted to $157,596,000, an average of 8.2 cents per thousand cubic feet. This average compares with 8.9 cents in 1928 and with 11.1 cents in 1922, the first year for which such data are available. The average price charged for natural gas at the wells in 1929 ranged from 2 cents per thousand in Utah to as high as 38.8 cents in Indiana.

The total value at points of consumption of the natural gas consumed in the United States in 1929 amounted to $413,153,000, an increase over 1928 of $49,522,000, or 14 per cent. The average value per thousand cubic feet at points of consumption was 21.5 cents in 1929, compared with 23.2 cents in 1928 and with 22 cents in 1927. In general, States, such as Ohio, in which the gas was used principally for domestic purposes, had a high average value at points of consumption, whereas States, such as Louisiana, in which the major portion of the gas was consumed for industrial purposes, had a low average value.

Natural gas produced in the United States and delivered to consumers, 1906–1929, by States, in millions of cubic feet

Year	Arkansas	California	Illinois	Indiana	Kansas	Kentucky	Louisiana	Montana	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Others	Total	Value at points of consumption	
																		Total (thousands of dollars)	Average per M cubic feet (cents)
1906	(1)	153	410	7,861	69,323	789	[2] 1,039	-------	2,548	45,436	3,520	138,161	(2)	119,400	(1)	203	388,843	46,874	12.1
1907	(1)	230	1,155	6,624	76,707	1,303	[2] 1,288	-------	3,288	52,041	4,867	135,516	(2)	122,687	(1)	916	406,622	54,222	13.3
1908	(1)	479	4,979	5,256	80,740	1,430	[2] 1,752	-------	3,843	47,442	11,925	130,476	(2)	112,181	(1)	1,638	402,141	54,640	13.6
1909	(1)	2,324	8,473	6,159	75,074	2,097	[2] 4,365	-------	4,696	53,223	28,037	127,697	(2)	166,435	(1)	2,126	480,706	63,207	13.1
1910	(1)	2,764	6,723	5,760	59,380	1,357	[2] 8,110	-------	6,010	48,232	50,430	126,867	(2)	190,706	(1)	2,816	509,155	70,756	13.9
1911	(1)	6,390	6,762	4,365	38,800	1,275	[3] 9,786	-------	5,240	49,450	67,276	108,869	5,503	206,891	(1)	2,386	512,993	74,622	14.5
1912	(1)	9,355	5,603	3,618	28,068	1,951	[3] 14,493	-------	8,626	56,210	73.799	112,150	7,470	239,007	(1)	1,853	562,203	84,564	15.0
1913	(1)	11,035	4,767	2,921	22,834	1,821	[3] 26,653	-------	8,515	50,612	75,018	118,860	12,160	245,454	(1)	1,198	581,898	87,847	15.1
1914	(1)	17,829	3,548	2,580	22,628	1,422	[3] 26,775	-------	8,935	68,270	78,167	110,745	13.434	236,489	(1)	1,045	591,867	94,116	15.9
1915	[4] 992	21,891	2,690	2,261	27,046	1,667	25,540	6	7,977	79.510	87,517	113,692	13,324	244,004	(1)	462	628,579	101,312	16.1
1916	2,388	31,643	3,534	1,715	31,719	2,107	32,081	213	8,036	69.888	123,517	130,484	15.810	299,319	(1)	725	753,170	120,227	16.0
1917	5,610	49,427	4,439	1,712	24,439	2,802	31.287	334	8,372	68,917	137,384	133,397	17,047	308,617	(1)	1,326	795,110	142,089	17.9
1918	5,295	39,719	4,473	1,667	27,825	3,022	36,094	177	8,461	61,261	124,317	123,813	13,440	265,161	4,339	1,937	721,001	153,554	21.3
1919	5,587	55,607	3,825	1,407	16,150	2,057	47,062	858	8,124	63,153	163,649	113,489	24,710	234,095	6,014	129	745,916	160,888	21.6
1920	9,027	66,041	3,013	1,779	21,158	3.345	58,274	818	8,419	58,938	154,467	125,787	37,063	239,719	10,312	50	798,210	196,194	24.6
1921	4,260	75,942	2,646	1,066	15,717	4,820	58,004	336	6,583	47,412	124,058	86,144	44,504	174,921	15,608	31	662,052	174,617	26.4
1922	9,700	84,580	3,383	947	20,289	5,872	70,267	486	6,947	51,481	140,631	101,276	47,945	195,288	23,427	27	762,546	221,535	29.1
1923	24,215	131,434	4,049	880	30,913	11,953	112,031	1,470	6,497	53,812	203,082	112,562	74,535	203,867	35,523	153	1,006,976	240,001	23.8
1924	36,616	189,692	4,072	998	25,580	12,875	160,945	1,071	6,196	47,396	214,452	105,863	107,247	182,285	46,036	197	1,141,521	253,856	22.2
1925	41,878	187,789	4,165	1,168	26,917	10,770	152.620	1,496	6,210	43,235	249,285	101,632	134,872	180,345	45,539	650	1,188,571	265,271	22.3
1926	43,566	204,915	3,808	901	38,095	10.410	157.423	2.283	7,027	47,363	286,421	107,089	175,392	180,223	46,567	1,536	1,313,019	300,168	22.9
1927	30,450	212,364	3,741	1,124	42,646	10,206	186,961	4,253	5,908	51,381	326,864	105,709	254,063	162,375	43,582	3,801	1,445,428	317,930	22.0
1928	20,235	246,215	3,051	1,290	45,644	15,383	227,821	6,277	7,224	56,341	320,861	99,466	301,990	163,018	47,490	5,833	1,568,139	363,726	23.2
1929	19,928	342,214	2,983	1,012	38,469	27,588	261,138	9,659	8,387	57,936	357,893	101,951	464,928	167,333	44,648	11,626	1,917,693	413,276	21.6

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[1] Included under "Others."
[2] Alabama and Texas included with Louisiana.
[3] Includes Alabama.
[4] Includes gas piped from Oklahoma and consumed in Arkansas.

Statistics of natural gas in the United States, 1906–1929

Year	Produced and delivered to consumers (billions of cubic feet)	Treated for recovery of natural gasoline		Domestic consumption					Industrial consumption [1]							
		Billions of cubic feet	Per cent of total consumption	Number of consumers (thousands)	Billions of cubic feet	Average number of M cubic feet used per consumer	Per cent of total consumption	Average value at points of consumption per M cubic feet (cents)	Field (billions of cubic feet)	Carbon black (billions of cubic feet)	Refineries (billions of cubic feet)	Electric public-utility power plants (billions of cubic feet)	Other industrial (billions of cubic feet)	Total industrial (billions of cubic feet)	Per cent of total consumption	Average value at points of consumption per M cubic feet (cents)
1906	389	(2)	(2)	875	110	126.2	28	22.7	(2)	(2)	(2)	(2)	(2)	279	72	7.8
1907	407	(2)	(2)	1,058	132	124.2	32	23.7	(2)	(2)	(2)	(2)	(2)	275	68	8.4
1908	402	(2)	(2)	1,166	141	120.6	35	23.6	(2)	(2)	(2)	(2)	(2)	261	65	8.2
1909	481	(2)	(2)	1,223	151	123.6	31	24.2	(2)	(2)	(2)	(2)	(2)	330	69	8.1
1910	509	(2)	(2)	1,328	170	127.9	33	24.4	(2)	(2)	(2)	(2)	(2)	339	67	8.6
1911	513	2	-------	1,498	175	117.1	34	25.3	(2)	(2)	(2)	(2)	(2)	338	66	9.0
1912	562	5	1	1,623	193	119.2	34	26.3	(2)	(2)	(2)	(2)	(2)	369	66	9.1
1913	582	10	2	1,911	185	96.8	32	27.3	(2)	(2)	(2)	(2)	(2)	397	68	9.4
1914	592	17	3	2,078	203	97.8	34	28.0	(2)	(2)	(2)	(2)	(2)	389	66	9.6
1915	629	24	4	2,195	217	98.9	35	28.3	(2)	(2)	(2)	(2)	(2)	412	65	9.7
1916	753	209	28	2,362	235	99.6	31	28.6	(2)	(2)	(2)	(2)	(2)	518	69	10.2
1917	795	429	54	2,431	258	106.2	32	30.8	(2)	(2)	(2)	(2)	(2)	537	68	11.7
1918	721	449	62	2,509	271	108.1	38	31.4	(2)	(2)	(2)	(2)	(2)	450	62	15.2
1919	746	480	64	2,501	256	102.2	34	34.6	170	50	(3)	21	[3] 249	490	66	14.8
1920	798	496	62	2,615	286	109.4	36	38.2	202	41	(3)	25	[3] 244	512	64	17.0
1921	662	465	70	2,631	248	94.4	38	44.4	182	51	(3)	24	[3] 157	414	62	15.5
1922	763	545	71	3,015	255	84.4	33	49.9	198	54	(3)	27	[3] 229	508	67	18.6
1923	1,007	876	87	3,234	277	85.7	28	51.4	343	109	(3)	31	[3] 247	730	72	13.4
1924	[4] 1,142	1,016	89	3,443	285	82.8	25	54.0	393	157	(3)	48	[3] 258	856	75	11.6
1925	[4] 1,189	1,040	88	3,508	272	77.6	23	56.0	424	140	38	46	218	916	77	12.3
1926	[4] 1,313	1,206	92	3,731	289	77.5	22	58.4	478	131	122	53	240	1,024	78	12.8
1927	[4] 1,445	1,341	93	3,984	296	74.3	20	60.8	549	144	123	63	270	1,149	80	12.0
1928	[4] 1,568	1,473	94	4,344	321	73.9	20	62.0	574	175	115	77	306	1,247	80	13.2
1929	[4] 1,918	1,959	102	5,116	360	70.3	19	62.0	705	261	104	113	375	1,558	81	12.2

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[1] Figures on consumption by public utilities from U. S. Geological Survey; others partly estimated.

[2] Figures not available.

[3] Refinery fuel included under "Other industrial"; separate figures not available.

[4] Includes gas piped to Canada and Mexico.

Natural gas produced and consumed in the United States, 1928 and 1929, by States

State	Produced and delivered to consumers, including deliveries in other States						Consumed, including receipts from other States			
	Quantity		Estimated value at the wells		Value at points of consumption		Quantity		Value at points of consumption	
	M cubic feet	Per cent of total	Total	Average per M cubic feet (cents)	Total	Average per M cubic feet (cents)	M cubic feet	Per cent of total	Total	Average per M cubic feet (cents)
1928										
Ark	20,235,000	1.3	$1,295,000	6.4	$3,562,000	17.6	37,763,000	2.4	$6,647,000	17.6
Calif	246.215,000	15.7	21,692,000	8.8	56,695,000	23.0	246,215,000	15.7	56,695,000	23.0
Colo	2,931,000	.2	293,000	10.0	786,000	26.8	6,347,000	.4	1,847,000	29.1
Ill	3,051,000	.2	305,000	10.0	360,000	11.8	3,051,000	.2	360,000	11.8
Ind	1,290,000	.1	448,000	34.7	639,000	49.5	2,259,000	.2	1,201,000	53.2
Kans	45,644,000	2.9	3,063,000	6.7	14,144,000	31.0	72,671,000	4.6	17,011,000	23.4
Ky	15,383,000	1.0	1,677,000	10.9	5,349,000	34.8	15,802,000	1.0	6,468,000	40.9
La	227,821,000	14.5	7,518,000	3.3	20,279,000	8.9	188,755,000	12.0	13,136,000	7.0
Mich	469,000	(1)	40,000	8.5	149,000	31.8	469,000	(1)	149,000	31.8
Mo	360,000	(1)	31,000	8.6	217,000	60.3	9,766,000	.6	5,902,000	60.4
Mont	6,277,000	.4	274,000	4.4	1,446,000	23.0	7,265,000	.5	1,524,000	21.0
N. Mex	838,000	(1)	43,000	5.1	66,000	7.9	854,000	.1	67,000	7.8
N. Y	[2] 7,224,000	.5	2,332,000	32.3	4,827,000	66.8	17,918,000	1.1	11,975,000	66.8
Ohio	56,341,000	3.6	10,125,000	18.0	32,090,000	57.0	122,484,000	7.8	70,295,000	57.4
Okla	320,861,000	20.5	20,984,000	6.5	47,476,000	14.8	285,333,000	18.2	38,845,000	13.6
Pa	99,466,000	6.3	29,114,000	29.3	48,432,000	48.7	116,150,000	7.4	54,388,000	46.8
S. Dak	54,000	(1)	5,000	9.3	53,000	98.1	214,000	(1)	212,000	99.1
Tex	[3] 301,990,000	19.3	10,328,000	3.4	51,316,000	17.0	318,718,000	20.3	54,270,000	17.0
Utah	1,105,000	.1	22,000	2.0	22,000	2.0	1,105,000	.1	22,000	2.0
W. Va	163,018,000	10.4	28,659,000	17.6	72,265,000	44.3	67,272,000	4.3	18,631,000	27.7
Wyo	47,490,000	3.0	1,643,000	3.5	3,527,000	7.4	46,549,000	3.0	3,290,000	7.1
Other [4]	76,000	(1)	7,000	9.2	26,000	34.2	1,019,000	.1	696,000	68.3
	1,568,139,000	100.0	139,898,000	8.9	363,726,000	23.2	1,567,979,000	100.0	363,631,000	23.2
1929										
Ark	19.928,000	1.0	1,303,000	6.5	3,802,000	19.1	39,758,000	2.1	7,587,000	19.1
Calif	342,214,000	17.9	29,054,000	8.5	68,972,000	20.2	342,214,000	17.8	68,972,000	20.2
Colo	2,787,000	.2	71,000	2.5	675,000	24.2	14,362,000	.7	4,539,000	31.6
Ill	2,983,000	.2	307,000	10.3	388,000	13.0	3,139,000	.2	408,000	13.0
Ind	1,012.000	.1	393,000	38.8	518,000	51.2	2,365,000	.1	1,335,000	56.4
Kans	38,469,000	2.0	3,001,000	7.8	13,429,000	34.9	75,476,000	3.9	18,807,000	24.9
Ky	27,588,000	1.4	3,506,000	12.7	8,822,000	32.0	19,444,000	1.0	7,041,000	36.2
La	261,138,000	13.6	7,913,000	3.0	26,505,000	10.1	200,777,000	10.5	15,427,000	7.7
Mich	4,526,000	.2	446,000	9.9	900,400	19.9	4,526,000	.2	900,400	19.9
Miss	90,000	(1)	7,000	7.8	32,000	35.6	574,000	(1)	246,000	42.9
Mo	324,000	(1)	32,000	9.9	164,000	50.6	15,078,000	.8	7,735,000	51.3
Mont	9,659,000	.5	409,000	4.2	2,377,000	24.6	9,332,000	.5	2,007,000	21.5
N. Mex	3,054,000	.2	152,000	5.0	536,000	17.6	1,021,000	.1	240,000	23.5
N. Y	[5] 8,387,000	.4	2,790,000	33.2	5,538,000	66.0	18,192,000	.9	12,059,000	66.3
Ohio	57,936,000	3.0	9,640,000	16.6	32,890,000	56.8	126,631,000	6.6	72,381,000	57.2
Okla	357,893,000	18.7	23,728,000	6.6	53,528,000	15.0	329,295,000	17.2	43,605,000	13.2
Pa	101,951,000	5.3	28,189,000	27.6	48,821,000	47.9	122,876,000	6.4	56,900,000	46.3
S. Dak	99,000	(1)	8,000	8.1	40,000	40.4	1,717,000	.1	696,000	40.5
Tenn	25,000	(1)	2,000	8.0	10,700	42.8	5,395,000	.3	2,181,700	40.4
Tex	[6] 464,928,000	24.3	15,575,000	3.3	67,474,000	14.5	465,526,000	24.3	65,577,000	14.1
Utah	693,000	(1)	14,000	2.0	205,000	29.6	1,539,000	.1	456,000	29.6
W. Va	167,333,000	8.7	29,384,000	17.6	73,793,000	44.1	73,856,000	3.9	20,022,000	27.1
Wyo	44,648,000	2.3	1,670,000	3.7	3,850,000	8.6	43,500,000	2.3	3,437,000	7.9
Other [4]	28,000	(1)	2,000	7.1	5,900	21.1	858,000	(1)	593,900	69.2
	1,917,693,000	100.0	157,596,000	8.2	413,276,000	21.6	1,917,451,000	100.0	413,153,000	21.5

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[1] Less than 0.1 per cent.

[2] Includes 84,000 M cubic feet consumed in Canada.

[3] Includes 76,000 M cubic feet consumed in Mexico.

[4] 1928: Alaska, Maryland (consumption only), Mississippi, North Dakota, and Tennessee; 1929: Alaska, Iowa, Maryland (consumption only), North Dakota, and Washington.

[5] Includes 103,000 M cubic feet consumed in Canada.

[6] Includes 139,000 M cubic feet consumed in Mexico.

DOMESTIC CONSUMPTION

There were 5,116,000 domestic consumers in 1929, compared with 4,344,000 in 1928. (See fig. 6.) California showed an increase of 61 per cent in number of consumers, gaining first rank by displacing Ohio. A large part of the gain in consumers in California was due to the completion of the San Francisco line the latter part of the year. Nearly all of the States showed increases in number of consumers over 1928, and no State reported a decrease. California and Ohio rank well ahead of the other States in number of consumers; their totals, 1,239,000 and 1,214,000, respectively, are nearly double that of Pennsylvania, the third in rank. Domestic distribution of natural gas was introduced into three States in 1929—namely, Iowa, Utah, and Washington. The most noteworthy of these new additions was Utah, in which the completion of a line from the Baxter Basin and Hiawatha fields to Salt Lake City added more than 35,000 new domestic consumers to the total. A comparable increase in number of domestic consumers was recorded as a result of the completion of a line from the Monroe and Richland fields to Memphis. Natural gas has been produced in small quantities in Washington for some time, but the first commercial

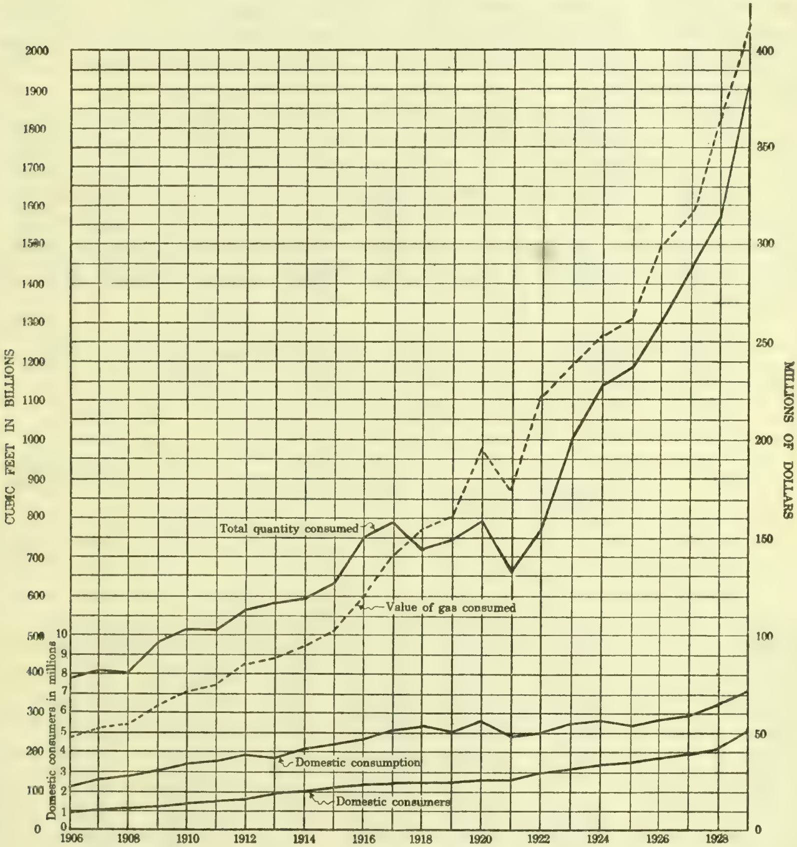

FIGURE 6.—Growth of natural-gas consumption in the United States, 1906–1929

utilization was that reported for 1929. The gas produced in 1929 came from the Rattlesnake field and was distributed to consumers in near-by towns.

The total consumption of natural gas for domestic purposes in 1929 amounted to 359,853,000,000 cubic feet, compared with 320,877,000,000 cubic feet in 1928, an increase of 12 per cent. The average consumption per domestic consumer, which has been declining steadily in recent years, fell off materially in 1929, when it amounted to only 70,300 cubic feet, compared with 73,900 cubic feet in 1928. This decline in 1929 was due primarily to the fact that the number of consumers includes those connected to the San Francisco line; as this line was not placed in operation until the latter part of the year, the consumption figure includes the gas used by these new consumers over a short period only.

The gas burned for domestic purposes in the United States in 1929 was valued at $223,172,000, or an average of 62 cents per thousand cubic feet, the same as the average reported for 1928. In 1929, for the first time since 1908, the average value did not increase over the preceding year. In only one State (Michigan) was the average value in 1929 above $1 per thousand cubic feet. Domestic consumers in West Virginia paid the lowest price for gas in 1929—34.6 cents per thousand cubic feet.

Natural gas consumed in the United States, 1928 and 1929, by States

State	Domestic				Industrial		
	Number of consumers	M cubic feet	Value at points of consumption		M cubic feet	Value at points of consumption	
			Total	Average (cents)		Total	Average (cents)
1928							
Arkansas	57,640	6,785,000	$3,281,000	48.4	30,978,000	$3,366,000	10.9
California	769,190	37,702,000	32,987,000	87.5	208,513,000	23,708,000	11.4
Colorado	69,030	629,000	697,000	110.8	5,718,000	1,150,000	20.1
Illinois	12,130	52,000	46,000	88.5	2,999,000	314,000	10.5
Indiana	15,910	791,000	490,000	61.9	1,468,000	711,000	48.4
Kansas	160,370	12,008,000	7,876,000	65.6	60,663,000	9,135,000	15.1
Kentucky	140,520	10,753,000	4,874,000	45.3	5,049,000	1,594,000	31.6
Louisiana	107,510	6,127,000	2,777,000	45.3	182,628,000	10,359,000	5.7
Michigan	9,600	60,000	90,000	150.0	409,000	59,000	14.4
Missouri	99,430	6,129,000	5,074,000	82.8	3,637,000	828,000	22.8
Montana	13,180	2,346,000	1,010,000	43.1	4,919,000	514,000	10.4
New Mexico	530	47,000	23,000	48.9	807,000	44,000	5.5
New York	241,660	16,391,000	11,229,000	68.5	1,527,000	746,000	48.9
Ohio	1,192,500	88,511,000	55,540,000	62.7	33,973,000	14,755,000	43.4
Oklahoma	216,000	23,185,000	11,811,000	50.9	262,148,000	27,034,000	10.3
Pennsylvania	615,360	52,971,000	32,409,000	61.2	63,179,000	21,979,000	34.8
South Dakota	2,470	214,000	212,000	99.1	------------	------------	--------
Texas	420,060	27,284,000	18,305,000	67.1	291,434,000	35,965,000	12.3
Utah	------------	------------	------------	--------	1,105,000	22,000	2.0
West Virginia	171,690	25,407,000	8,394,000	33.0	41,865,000	10,237,000	24.5
Wyoming	12,680	2,729,000	1,071,000	39.2	43,820,000	2,219,000	5.1
Other [1]	16,040	756,000	612,000	81.0	263,000	84,000	31.9
	4,343,500	320,877,000	198,808,000	62.0	1,247,102,000	164,823,000	13.2

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[1] 1928: Alaska, Maryland, Mississippi, North Dakota, and Tennessee.

Natural gas consumed in the United States, 1928 and 1929, by States—Continued

State	Domestic				Industrial		
	Number of consumers	M cubic feet	Value at points of consumption		M cubic feet	Value at points of consumption	
			Total	Average (cents)		Total	Average (cents)
1929							
Arkansas	61, 620	7, 535, 000	$3, 661, 000	48. 6	32, 223, 000	$3, 926, 000	12. 2
California	1, 239, 150	43, 499, 000	37, 785, 000	86. 9	298, 715, 000	31, 187, 000	10. 4
Colorado	77, 150	2, 731, 000	2, 524, 000	92. 4	11, 631, 000	2, 015, 000	17. 3
Illinois	13, 160	94, 000	79, 000	84. 0	3, 045, 000	329, 000	10. 8
Indiana	16, 230	696, 000	451, 000	64. 8	1, 669, 000	884, 000	53. 0
Kansas	169, 740	15, 539, 000	9, 391, 000	60. 4	59, 937, 000	9, 416, 000	15. 7
Kentucky	156, 850	11, 501, 000	5, 238, 000	45. 5	7, 943, 000	1, 803, 000	22. 7
Louisiana	115, 050	7, 917, 000	4, 275, 000	54. 0	192, 860, 000	11, 152, 000	5. 8
Michigan	11, 190	342, 000	356, 000	104. 1	4, 184, 000	544, 400	13. 0
Mississippi	4, 250	518, 000	234, 000	45. 2	56, 000	12, 000	21. 4
Missouri	121, 150	7, 224, 000	6, 176, 000	85. 5	7, 854, 000	1, 559, 000	19. 8
Montana	15, 250	3, 033, 000	1, 290, 000	42. 5	6, 299, 000	717, 000	11. 4
New Mexico	1, 970	181, 000	118, 000	65. 2	840, 000	122, 000	14. 5
New York	248, 100	16, 531, 000	11, 130, 000	67. 3	1, 661, 000	929, 000	55. 9
Ohio	1, 214, 170	88, 169, 000	56, 271, 000	63. 8	38, 462, 000	16, 110, 000	41. 9
Oklahoma	225, 050	31, 263, 000	13, 929, 000	44. 6	298, 032, 000	29, 676, 000	10. 0
Pennsylvania	634, 180	53, 223, 000	32, 707, 000	61. 5	69, 653, 000	24, 193, 000	34. 7
South Dakota	3, 710	870, 000	546, 000	62. 8	847, 000	150, 000	17. 7
Tennessee	35, 840	1, 311, 000	1, 280, 000	97. 6	4, 084, 000	901, 700	22. 1
Texas	503, 070	38, 830, 000	24, 878, 000	64. 1	426, 696, 000	40, 699, 000	9. 5
Utah	35, 640	397, 000	356, 000	89. 7	1, 142, 000	100, 000	8. 8
West Virginia	184, 620	24, 921, 000	8, 624, 000	34. 6	48, 935, 000	11, 398, 000	23. 3
Wyoming	14, 820	2, 877, 000	1, 340, 000	46. 6	40, 623, 000	2, 097, 000	5. 2
Other [2]	13, 640	651, 000	533, 000	81. 9	207, 000	60, 900	29. 4
	5, 115, 600	359, 853, 000	223, 172, 000	62. 0	1, 557, 598, 000	189, 981, 000	12. 2

[2] 1929: Alaska, Iowa, Maryland, North Dakota, and Washington.

INDUSTRIAL CONSUMPTION

The total consumption of natural gas for industrial purposes in 1929 amounted to 1,557,598,000,000 cubic feet, an increase over 1928 of 25 per cent. (See fig. 7.) Of the total 705,083,000,000 cubic feet, or 45 per cent, was used for field purposes; 261,107,000,000 cubic feet, or 17 per cent, was burned for carbon black; 112,707,000,000 cubic feet, or 7 per cent, was burned as fuel by public-utility power plants; and 103,729,000,000 cubic feet, or 7 per cent, was used for fuel in the refining of petroleum, leaving 374,972,000,000 cubic feet, or 24 per cent, for miscellaneous industrial purposes. These figures indicate gains in the percentages for carbon black and public-utility plants at the expense of the other uses.

The average value per thousand cubic feet of natural gas for industrial purposes in 1929 was 12.2 cents, compared with 13.2 cents in 1928. This decrease was due largely to the decline in value of gas for field purposes, although the average value of the gas burned for carbon black and of that used for "other industrial" purposes also fell off.

The consumption of natural gas for field purposes easily retained first rank among the various classes of consumption. During 1929 a total of 705,083,000,000 cubic feet was utilized in the operation of natural-gasoline plants and burned under boilers or used as fuel for gas engines incident to the drilling and pumping of wells. The increase in field consumption in 1929 checks closely with the increase in number of wells completed and with gains in natural-gasoline production. Oklahoma and California were the leading users of gas for field purposes in 1929; Texas, the leading State with respect to well completions in 1929, was third, probably because of a more widespread use of oil for fuel in that State.

The use of natural gas in the manufacture of carbon black ranked next to field use among the industrial uses; it accounted for a consumption of 261,107,000,000 cubic feet in 1929, an increase over 1928 of 49 per cent. As was predicted in the report of this series for 1928, Texas became the leading carbon-black producing State in 1929. The production of carbon black in the Panhandle in 1929 was more than three times the 1928 total, and as the status of the industry in Louisiana was practically unchanged the center of carbon-black

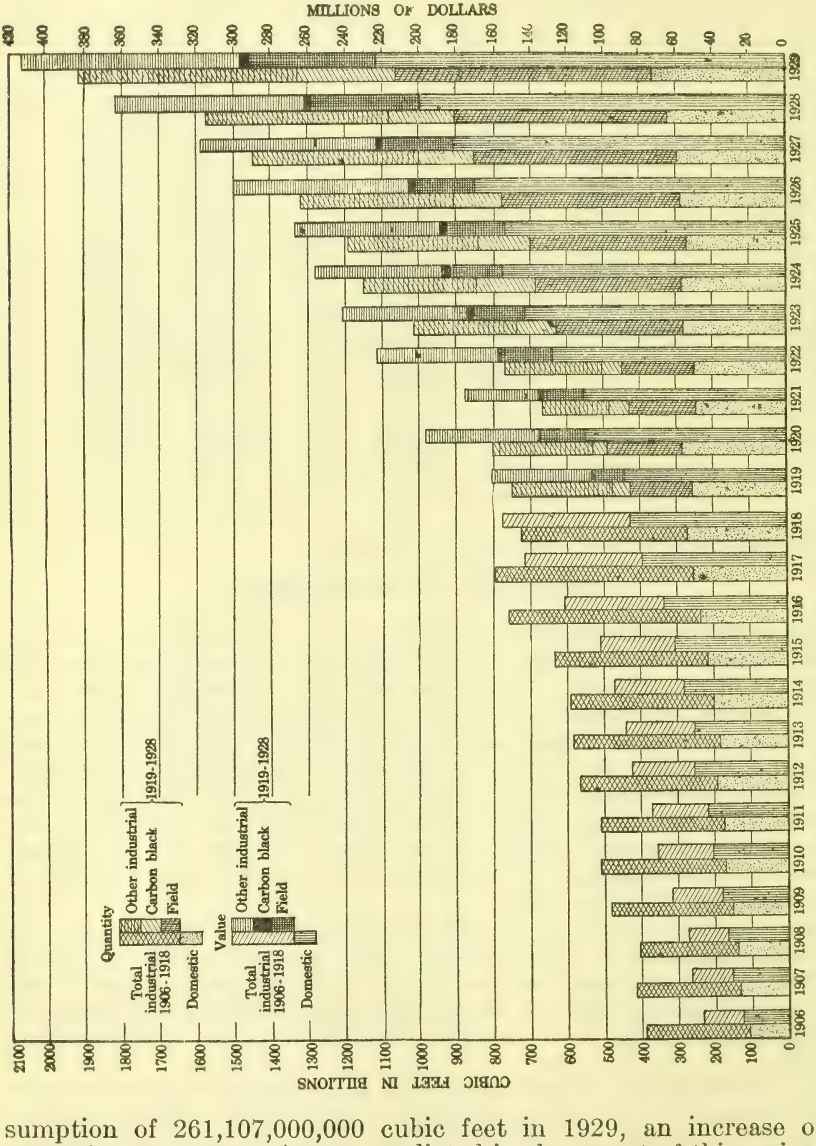

FIGURE 7.—Quantity and value of natural gas consumed in the United States, 1906-1929

manufacture moved from Monroe to Amarillo. The gas burned in the manufacture of carbon black in 1929 had a total value at points of consumption of $5,108,000, representing an average of only 2 cents per thousand cubic feet, compared with an average of 2.5 cents in 1928. The gas burned for carbon black in Texas had an average value of 1.7 cents per thousand cubic feet, compared with 2.5 cents in 1928. This decline in value in Texas was the main cause of the decline in the national average. The comparatively small quantity of gas burned for carbon black in West Virginia was valued at the high average of 14 cents per thousand cubic feet.

The use of natural gas as refinery fuel continued to decline in 1929, when the total consumed was 103,729,000,000 cubic feet, compared with 114,950,000,000 cubic feet in 1928. Although the price may have been a factor in the decreased use of natural gas by refineries, the chief reason was an increase in the supply of other fuels, notably, fuel oil and refinery gas. Fuel-oil prices were so low in 1929 that the oil, particularly residual fuel oil from cracking stills, could not be disposed of except as fuel under boilers and stills. Furthermore, increased cracking and more efficient refining methods led to a material gain in the recovery of still gas and to a similar increase in its use as refinery fuel. Although natural gas as a refinery fuel meets with severe competition from other fuels, it continues to be the primary fuel at refineries in Louisiana, Arkansas, and practically all the Rocky Mountain States.

The United States Geological Survey reports the consumption of natural gas as a fuel in the generation of electric power by public-utility plants in 1929 as 112,707,000,000 cubic feet, an increase over 1928 of 35,381,000,000 cubic feet, or 46 per cent. Texas continued to lead in the use of natural gas for generating electricity, although some of the other States made larger relative gains in 1929.

The heading "Industrial consumption" covers all consumption except domestic consumption. The quantities include gas used for field purposes, for carbon black, at refineries, at public-utility power plants, and for miscellaneous industrial purposes. The trend in consumption by miscellaneous industries is important because it supplies the most accurate indications of the displacement of coal, oil, and other fuels by natural gas. During 1929 a total of 374,972,000,000 cubic feet of gas was used by miscellaneous industries, compared with 305,991,000,000 cubic feet in 1928, a gain of 23 per cent.

Among the miscellaneous industries that utilize natural gas as fuel are steelworks, ceramics, glassworks, cement plants, cotton gins and presses, chemical works, sugar refineries, salt works, bakeries, and sulphur mines.

Natural gas has been used by steel mills in the vicinity of Pittsburgh for many years. The ease of temperature control makes it particularly adaptable for use in melting and in the heat treatment of metals. Furthermore, it has been proved that the refractory life of furnaces is longer when natural gas is used. Natural gas is practically free from sulphur, and this quality is of prime importance in the manufacture of steel, glass, and ceramic products. The even temperature obtained through the use of gas results in fewer "seconds" and rejections. The freedom from soot, as well as the ease of temperature control, makes gas an ideal fuel for use in bakeries.

The use of natural gas as fuel in the manufacture of cement has increased rapidly in recent years. During 1929 a total of 24 cement plants reported the use of natural gas as fuel, compared with 15 in 1928.[2] The total estimated consumption by these plants rose from 30,660,348,200 cubic feet in 1928 to 41,643,433,000 cubic feet in 1929, an increase of 35 per cent.

Although the average selling price of gas for miscellaneous industrial purposes in 1929 was only about 20 cents per thousand cubic feet and the average value for domestic purposes was more than three times that amount, a number of long lines have been built to serve primarily industrial consumers. The chief advantage accruing from the construction of such lines is the assurance of a favorable load factor, the chief problem with which gas engineers must contend.

Among the States showing an increase in quantity of gas used for miscellaneous industrial purposes in 1929 are California, Colorado, Kentucky, Louisiana, Michigan, Missouri, and Texas. Statistics showing the particular industries responsible for these gains are not available.

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[2] Bagley, B. W., Cement in 1929: Mineral Resources of the United States, 1929, Pt. II, Bureau of Mines, p. 409.

Industrial consumption of natural gas in the United States, 1928 and 1929, by States and uses

State	Field (drilling, pumping, and operating gasoline recovery plants)		Manufacture of carbon black			Fuel at petroleum refineries and electric public-utility power plants and other industrial				
	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet			Value at points of consumption	
				Total	Average (cents)	Petroleum refineries	Electric public-utility power plants	Other industrial	Total	Average (cents)
1928										
Arkansas	13, 728, 000	$1, 086, 000				3, 737, 000	1, 573, 000	11, 940, 000	$2, 280, 000	13. 2
California	149, 307, 000	13, 273, 000				17, 403, 000	12, 849, 000	28, 954, 000	10, 435, 000	17. 6
Colorado	1, 180, 000	118, 000				4, 000		4, 534, 000	1, 032, 000	22. 7
Illinois	2, 931, 000	295, 000						68, 000	19, 000	27. 9
Indiana	85, 000	9, 000						1, 383, 000	702, 000	50. 8
Kansas	14, 782, 000	1, 380, 000				7, 171, 000	8, 838, 000	29, 872, 000	7, 755, 000	16. 9
Kentucky	968, 000	112, 000	218, 000	$22, 000	10. 1		16, 000	3, 847, 000	1, 460, 000	37. 8
Louisiana	26, 004, 000	1, 211, 000	104, 670, 000	2, 473, 000	2. 4	22, 034, 000	10, 138, 000	19, 782, 000	6, 675, 000	12. 8
Michigan	99, 000	9, 000						310, 000	50, 000	16. 1
Missouri	8, 000	1, 000						3, 629, 000	827, 000	22. 8
Montana	1, 116, 000	106, 000	1, 760, 000	35, 000	2. 0	351, 000	612, 000	1, 080, 000	373, 000	18. 3
New Mexico	772, 000	39, 000				27, 000		8, 000	5, 000	14. 3
New York	716, 000	238, 000					20, 000	791, 000	508, 000	62. 6
Ohio	3, 850, 000	1, 406, 000					4, 206, 000	25, 917, 000	13, 349, 000	44. 3
Oklahoma	205, 159, 000	19, 474, 000				16, 184, 000	8, 709, 000	32, 096, 000	7, 560, 000	13. 3
Pennsylvania	6, 606, 000	2, 229, 000				1, 173, 000	73, 000	55, 327, 000	19, 750, 000	34. 9
Texas	106, 034, 000	12, 749, 000	62, 749, 000	1, 576, 000	2. 5	29, 641, 000	29, 886, 000	63, 124, 000	21, 640, 000	17. 6
Utah			1, 105, 000	22, 000	2. 0					
West Virginia	17, 876, 000	3, 767, 000	494, 000	69, 000	14. 0	1, 519, 000	187, 000	21, 789, 000	6, 401, 000	27. 2
Wyoming	22, 473, 000	853, 000	4, 141, 000	124, 000	3. 0	15, 706, 000	219, 000	1, 281, 000	1, 242, 000	7. 2
Other States[1]	4, 000	1, 000						259, 000	83, 000	32. 0
	573, 698, 000	58, 356, 000	175, 137, 000	4, 321, 000	2. 5	114, 950, 000	77, 326, 000	305, 991, 000	102, 146, 000	20. 5

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[1] Alaska, Maryland, Mississippi, and North Dakota.

Industrial consumption of natural gas in the United States, 1928 and 1929, by States and uses—Continued

State	Field (drilling, pumping, and operating gasoline recovery plants)		Manufacture of carbon black			Fuel at petroleum refineries and electric public-utility power plants and other industrial				
	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet			Value at points of consumption	
				Total	Average (cents)	Petroleum refineries	Electric public-utility power plants	Other industrial	Total	Average (cents)
1929										
Arkansas	15, 221, 000	$1, 274, 000	-----	-----	-----	4, 548, 000	1, 222, 000	11, 232, 000	$2, 652, 000	15. 6
California	216, 337, 000	18, 409, 000	-----	-----	-----	17, 205, 000	26, 914, 000	38, 259, 000	12, 778, 000	15. 5
Colorado	830, 000	27, 000	-----	-----	-----	5, 000	-----	10, 796, 000	1, 988, 000	18. 4
Illinois	2, 895, 000	297, 000	-----	-----	-----	-----	-----	150, 000	32, 000	21. 3
Indiana	23, 000	3, 000	-----	-----	-----	-----	-----	1, 646, 000	881, 000	53. 5
Kansas	11, 990, 000	1, 470, 000	-----	-----	-----	6, 231, 000	11, 288, 000	30, 428, 000	7, 946, 000	16. 6
Kentucky	1, 291, 000	162, 000	-----	-----	-----	-----	-----	6, 652, 000	1, 641, 000	24. 7
Louisiana	25, 030, 000	1, 006, 000	103, 846, 000	$2, 355, 000	2. 3	16, 971, 000	17, 284, 000	29, 729, 000	7, 791, 000	12. 2
Michigan	520, 000	51, 000	-----	-----	-----	-----	-----	3, 664, 000	493, 400	13. 5
Mississippi	4, 000	1, 000	-----	-----	-----	-----	33, 000	19, 000	11, 000	21. 2
Missouri	12, 000	2, 000	-----	-----	-----	-----	456, 000	7, 386, 000	1, 557, 000	19. 9
Montana	1, 008, 000	115, 000	2, 142, 000	43, 000	2. 0	248, 000	571, 000	2, 330, 000	559, 000	17. 8
New Mexico	555, 000	33, 000	-----	-----	-----	-----	25, 000	260, 000	89, 000	31. 2
New York	269, 000	96, 000	-----	-----	-----	250, 000	23, 000	1, 119, 000	833, 000	59. 8
Ohio	5, 117, 000	1, 448, 000	-----	-----	-----	13, 000	4, 070, 000	29, 262, 000	14, 662, 000	44. 0
Oklahoma	247, 539, 000	23, 150, 000	(2)	(2)	(2)	15, 189, 000	8, 606, 000	[3] 26, 698, 000	[3] 6, 526, 000	12. 9
Pennsylvania	6, 929, 000	2, 118, 000	-----	-----	-----	939, 000	69, 000	61, 716, 000	22, 075, 000	35. 2
South Dakota	-----	-----	-----	-----	-----	-----	-----	847, 000	150, 000	17. 7
Tennessee	(2)	(2)	-----	-----	-----	-----	3, 392, 000	[4] 692, 000	[4] 901, 700	22. 1
Texas	128, 454, 000	14, 067, 000	150, 975, 000	2, 583, 000	1. 7	26, 115, 000	38, 365, 000	82, 787, 000	24, 049, 000	16. 3
Utah	-----	-----	(2)	(2)	(2)	-----	-----	[3] 1, 142, 000	[3] 100, 000	8. 8
West Virginia	18, 844, 000	3, 722, 000	342, 000	48, 000	14. 0	1, 684, 000	153, 000	27, 912, 000	7, 628, 000	25. 6
Wyoming	22, 207, 000	900, 000	(2)	(2)	(2)	14, 331, 000	236, 000	[3] 3, 849, 000	[3] 1, 197, 000	6. 5
Other States [5]	8, 000	1, 000	3, 802, 000	79, 000	2. 1	-----	-----	205, 000	60, 900	29. 7
	705, 083, 000	68, 352, 000	261, 107, 000	5, 108, 000	2. 0	103, 729, 000	112, 707, 000	374, 972, 000	116, 521, 000	19. 7

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[2] Included under "Other States" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.
[3] Includes gas consumed in manufacture of carbon black.
[4] Includes gas consumed in field operations.
[5] Alaska, Maryland, and North Dakota.

INTERSTATE TRANSPORTATION

Interstate transportation of natural gas grew rapidly in importance in 1929 following the completion of several large lines traversing a number of States. The total transported between States in 1929—that is, from the State of origin to the State of final distribution—amounted to 325,021,000,000 cubic feet. (See fig. 8.) This total is 17 per cent of the total production and represents an increase over 1928 of 35 per cent.

With respect to quantity, the most important single interstate movement was that from wells in West Virginia to consuming centers in Ohio. During 1929 a total of 69,976,000,000 cubic feet of gas was transported from West Virginia to Ohio, compared with 66,319,000,000 cubic feet in 1928. Gas moves to Ohio from West Virginia through a number of systems, the most important of which embrace 18 and 20 inch lines to Cleveland and 16 and 18 inch lines toward Columbus and other cities in the central part of the State. West Virginia is the State of origin for two other important interstate movements, namely, those to Pennsylvania and Kentucky. Gas moving from West Virginia to Pennsylvania moves through a number of lines, the majority of which terminate at Pittsburgh. Pittsburgh was one of the first large cities to utilize natural gas. In the early days its supply was obtained from numerous near-by fields, but these were soon depleted and the city turned to West Virginia as its chief source of supply. The movement of gas from West Virginia to Kentucky amounted to 4,411,000,000 cubic feet in 1929, compared with 7,193,000,000 cubic feet in 1928. Such movement has declined in recent years following the rapid increase in production in the Kentucky fields.

The second most important single interstate movement was that from Oklahoma to Kansas, amounting to 51,797,000,000 cubic feet in 1929, a material increase over 1928. Some of this gas originates in the Panhandle, but the major portion is residue gas from gasoline plants in or near producing oil fields in Oklahoma. This gas travels north to Wichita, Topeka, Kansas City, and other cities in Kansas by several different pipe-line systems, most of which are 16 inches in diameter as they cross the State boundary.

Texas is the leading gas-producing State, yet shipments into Texas from other States, notably from Louisiana, are of material importance. Shipments from Louisiana to Texas amounted to 34,824,000,000 cubic feet in 1929, compared with 25,031,000,000 cubic feet in 1928. Practically all of this gas travels through two systems, both originating in the Monroe and Richland fields. One line, consisting mainly of 22-inch pipe, runs to Houston; the other system has two main branches, one to Dallas and the other to Beaumont. The Dallas line is used mainly to deliver gas for domestic purposes; the Beaumont line is used mainly to supply a few large important industrial consumers. Another important movement of gas into Texas was from New Mexico. This was all transported through a 16-inch line that runs from the Lea field in the extreme southeast corner of New Mexico to El Paso.

The Panhandle contains the largest and best-known gas reserve in the United States and, with the possible exception of the Monroe-Richland area, far outranks the other fields as a starting point for large interstate lines. Probably the best known among the interstate lines leaving the Panhandle is the Denver line, completed late in 1928. It consists of 20 and 22 inch pipe and is approximately 340 miles long. When it was under construction, it attracted widespread interest because of its size and the rough nature of the country traversed.

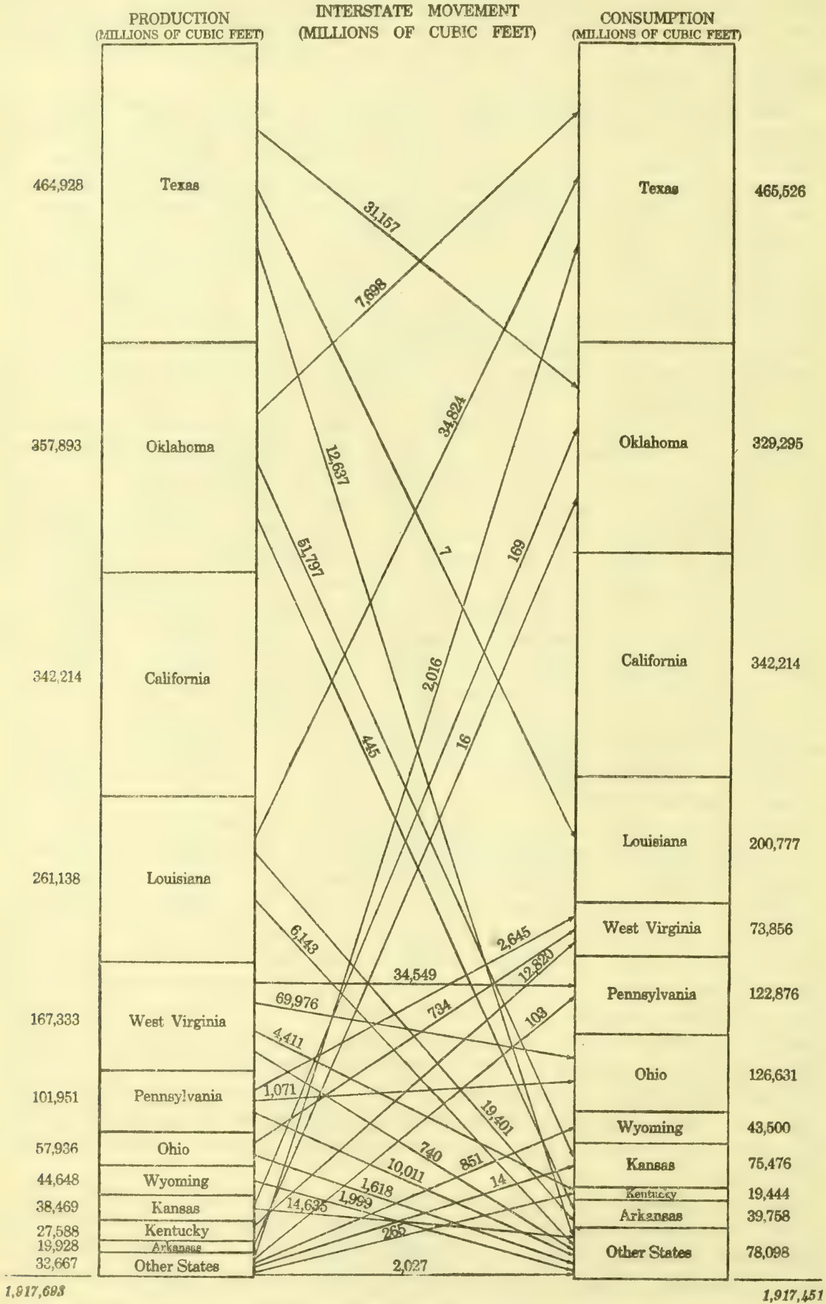

FIGURE 8.—Interstate movement of natural gas in the United States in 1929 and relative importance of principal States in production and consumption

Several other interstate lines were completed and placed in operation in 1929, the most important of which are the Wyoming to Salt Lake City line and the lines from Monroe to Memphis and St. Louis. The Memphis line consists of 18-inch pipe and is about 250 miles long. It was completed December 28, 1928, but was not placed in operation until 1929. The St. Louis line consists of 22-inch pipe and is approximately 450 miles long. It was built to serve primarily industrial consumers, but the Memphis and Salt Lake City lines are used to serve domestic consumers also.

Interstate transportation of natural gas, 1928 and 1929, in thousands of cubic feet [1]

State from which gas was transported	State to which gas was transported	1928	1929
Arkansas	Oklahoma	----------	16,000
Colorado	Utah	----------	228,000
	Wyoming	285,000	851,000
		[2] 285,000	1,079,000
Indiana	Kentucky	382,000	265,000
Kansas	Missouri	9,406,000	14,635,000
	Oklahoma	236,000	169,000
		9,642,000	14,804,000
Kentucky	West Virginia	7,156,000	12,820,000
Louisiana	Arkansas	17,384,000	19,401,000
	Illinois	----------	156,000
	Mississippi	112,000	484,000
	Missouri	----------	133,000
	Tennessee	----------	5,370,000
	Texas	25,031,000	34,824,000
		42,527,000	60,368,000
Missouri	Kansas	----------	14,000
Montana	North Dakota	78,000	90,000
	South Dakota	160,000	1,618,000
		238,000	1,708,000
New Mexico	Colorado	----------	91,000
	Texas	----------	2,016,000
		----------	2,107,000
New York	Canada	84,000	103,000
	Pennsylvania	----------	103,000
		84,000	206,000
Ohio	Indiana	1,351,000	1,618,000
	West Virginia	636,000	734,000
		1,987,000	2,352,000
Oklahoma	Arkansas	144,000	445,000
	Kansas	36,669,000	51,797,000
	Texas	5,740,000	7,698,000
		42,553,000	59,940,000
Pennsylvania	New York	10,778,000	10,011,000
	Ohio	1,811,000	1,071,000
	West Virginia	2,560,000	2,645,000
		15,149,000	13,727,000
Texas	Colorado	[2] 3,701,000	12,563,000
	Louisiana	3,461,000	7,000
	Mexico	76,000	139,000
	New Mexico	[2] 16,000	74,000
	Oklahoma	6,789,000	31,157,000
		14,043,000	43,940,000

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[1] In general the gas is produced in the State from which it is listed as transported. In some cases the gas travels through several States before reaching points of consumption.

[2] Revised figures.

Interstate transportation of natural gas, 1928 and 1929, in thousands of cubic feet—Continued

State from which gas was transported	State to which gas was transported	1928	1929
West Virginia	Kentucky	7,193,000	4,411,000
	Maryland	753,000	740,000
	Ohio	66,319,000	69,976,000
	Pennsylvania	31,833,000	34,549,000
		106,098,000	109,676,000
Wyoming	Montana	1,226,000	1,381,000
	Utah		618,000
		1,226,000	1,999,000
		[2] 241,370,000	325,021,000

[2] Revised figures.

NATURAL-GAS WELLS

A survey made in 1929 showed that there were approximately 53,545 producing gas wells in the United States. This figure includes only wells that are strictly gas wells; that is, it does not include wells that produce both oil and gas. As this survey is the first attempt for some time to gather information as to the number of wells, a comparison with 1928 can not be made. In view of the increased interest in natural gas in 1929, however, it is probable that there was a substantial gain in number of producing gas wells between January 1 and December 31, 1929. This increase probably exceeded the number of gas wells completed during the year inasmuch as the number of old wells cleaned and put into operating condition probably exceeded the number abandoned.

Pennsylvania easily led in 1929 in number of producing gas wells, with West Virginia second and Ohio third. California, one of the leading gas-producing States, had only 75 producing gas wells in 1929, as gas is rarely found in California unassociated with oil.

Approximate number of producing gas wells in the United States, December 31, 1929

State	Number	State	Number
Arkansas	150	Michigan	25
California	75	Montana	140
Colorado, New Mexico, Utah, and Washington	40	New York	2,150
Illinois	85	Ohio	6,500
Indiana	1,110	Oklahoma	3,060
Iowa, Missouri, North Dakota, and South Dakota	20	Pennsylvania	19,770
Kansas	3,930	Texas	1,500
Kentucky and Tennessee	1,240	West Virginia	12,600
Louisiana and Mississippi	1,030	Wyoming	120
			53,545

During 1929, 2,870 gas wells were completed in the United States, exclusive of California (for which State the record is lacking), compared with 2,727 in 1928, an increase of 5 per cent.

Ohio, with 801, was the leading State in number of gas-well completions in 1929. This figure represents a very material gain over 1928, although the total output of gas in Ohio in 1929 was only slightly higher than in 1928. Texas, West Virginia, and Oklahoma, with 579, 399, and 369 completions, respectively, followed Ohio in rank. Completions in both Oklahoma and Kansas decreased materially in 1929, a reflection of the decline in drilling activity in that area.

Important counties or districts with respect to the number of gas-well completions in 1929 were as follows: Athens County, Ohio, with 102 completions; Ouachita Parish, La., with 89; Mirando district and Wheeler County, Tex., with 79 and 75, respectively; and Boone County, W. Va., with 67.

Gas wells drilled in the United States in 1929, by States and by counties or districts[1]

State and county or district	Number of gas wells
Arkansas:	
Johnson	2
Madison	1
Ouachita	1
Pope	1
Union	14
	19
Total for 1928	29
California	(2)
Colorado:	
Las Animas	4
Moffat	1
	5
Total for 1928	1
Illinois:	
Crawford	2
	2
Total for 1928	8
Indiana:	
Daviess	2
Gibson	12
Hancock	1
Henry	3
Madison	1
Marion	1
Monroe	1
Pike	10
Shelby	2
Sullivan	3
	36
Total for 1928	38
Kansas:	
Allen	1
Anderson	2
Barber	2
Chautauqua	5
Coffey	3
Cowley	17
Elk	1
Greenwood	2
Harvey	1
McPherson	2
Marion	1
Montgomery	5
Morris	1
Neosho	2
Sedgwick	4
Stevens	1
Sumner	1
Wilson	1
	52
Total for 1928	115
Kentucky:	
Barren	4
Caldwell	2
Clay	3
Daviess	6
Floyd	4
Hancock	9
Hopkins	6
Jackson	2
Lawrence-Johnson	1
Lee-Owsley	2
Ohio	33
Perry	1
Pike	1
Rowan	1
Trigg	1
Warren	2
Webster	4
	82
Total for 1928	48
Louisiana:	
Gulf coast—	
Lockport	3
Miscellaneous	3
	6
Total for 1928	4
Northern—	
Bienville	2
Bossier	22
Caddo	7
De Soto	3
East Carroll	1
La Salle	1
Morehouse	36
Ouachita	89
Red River	2
Richland	61
Union	33
Webster	23
West Carroll	1
	281
Total for 1928	229
Total Louisiana, 1929	287
1928	233
Michigan:	
Clare	1
Isabella	1
Manistee	3
Mason	2
Muskegon	23
Newaygo	1
	31
Total for 1928	29

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[1] Oil and Gas Journal.

[2] Not reported.

Gas wells drilled in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Number of gas wells
Mississippi:	
Monroe	1
	1
Total for 1928	1
Montana:	
Big Horn	2
Carter	1
Fallon	17
Glacier	1
Kevin-Sunburst	40
Liberty	2
Phillips	1
Stillwater	1
Toole	1
	66
Total for 1928	56
New Mexico:	
Eddy	2
Lea	14
	16
Total for 1928	6
Ohio:	
Central and Eastern—	
Ashland	76
Athens	102
Coshocton	12
Fairfield	9
Guernsey	23
Hocking	7
Holmes	38
Jackson	33
Knox	32
Licking	33
Lorain	32
Medina	19
Meigs	42
Monroe	8
Muskingum	35
Noble	8
Perry	47
Richland	11
Stark	14
Summit	66
Washington	14
Wayne	44
Miscellaneous	71
	776
Total for 1928	496
Northwestern—	
Hancock	6
Hardin	1
Lucas	2
Sandusky	3
Seneca	12
Wyandot	1
	25
Total for 1928	19
Total Ohio, 1929	801
1928	515
Oklahoma:	
Beckham	6
Carter	7
Cherokee	1
Cotton	2
Creek	34
Dewey	1
Garfield	2
Grady	19
Grant	5
Oklahoma—Continued.	
Haskell	2
Hughes	17
Kay	17
Kiowa	1
Latimer	6
Le Flore	4
Lincoln	4
Logan	3
Marshall	2
Muskogee	25
Noble	3
Nowata	2
Okfuskee	19
Oklahoma	5
Okmulgee	23
Osage	35
Pawnee	5
Payne	3
Pittsburg	4
Pontotoc	7
Pottawatomie	11
Seminole	44
Sequoyah	2
Stephens	17
Tulsa	6
Wagoner	25
	369
Total for 1928	491
Pennsylvania and New York:	
Bradford	1
Butler-Armstrong	17
Middlefield	1
Venango-Clarion	47
Southwestern Pennsylvania	50
	116
Total for 1928	169
Tennessee:	
1929	
1928	7
Texas:	
Gulf coast—	
Big Creek	1
Boling	1
Clay Creek	4
Hull	2
North Dayton	1
Pierce Junction	2
Raccoon Bend	4
Refugio	36
Miscellaneous	7
	58
Total for 1928	[3] 43
Rest of State—	
Northern, Central, Eastern, and Southwestern—	
Agua Dulce	9
Anderson	5
Brown	12
Callahan	2
Clay	2
Coleman	28
Comanche	2
Eastland	18
Erath	22
Foard	1
Grayson	9
Harrison	17
Jack	4
McCulloch	1
Milam	1
Mirando	79
Montague	1

[3] Revised figures.

Gas wells drilled in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Number of gas wells
Texas—Continued.	
Rest of State—Continued.	
Northern, Central, Eastern, and Southwestern—Continued.	
Palo Pinto	14
Panola	57
Peters	1
Salt Flat (Bruner)	3
Saxet	1
Shackelford	5
Somerset	1
Stephens	23
Throckmorton	3
West	1
Miscellaneous	48
	370
Total for 1928	[3] 402
Panhandle—	
Carson	21
Gray	24
Hartley	2
Hutchinson	9
Moore	8
Wheeler	75
	139
Total for 1928	100
West Texas—	
Mitchell	2
Pecos	7
Ward	1
Winkler	2
	12
Total for 1928	13
Total "Rest of State," 1929	521
1928	[3] 515
Total Texas, 1929	579
1928	558
Utah:	
1929	
1928	5
West Virginia:	
Boone	67
Cabell	23
Calhoun	57
Doddridge	9
Gilmer	24
Harrison	7
Kanawha	24
Lincoln	47
Marion	11
Marshall	7
Mingo	14
Monongalia	6
Ritchie	22
Roane	12
Wayne	10
Wetzel and Tyler	16
Miscellaneous	43
	399
Total for 1928	404
Wyoming:	
Big Horn	2
Carbon	2
Fremont	1
Sweetwater	4
	9
Total for 1928	14
Total United States, 1929	2,870
1928	2,727

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[3] Revised figures.

SURVEY OF NATURAL-GAS PIPE LINES

The rapid growth in the distribution of natural gas during 1929 greatly stimulated public interest in natural-gas pipe lines, particularly in maps showing the size and location of the lines. To meet this demand the Bureau of Mines compiled and issued a complete up-to-date map of natural-gas lines as of July 1, 1929. The supply of this map has long been exhausted, but the principal lines as of a more recent date have been incorporated in a smaller map.

On July 1, 1929, natural-gas trunk lines traversed 29 States. The estimated mileage was distributed among the States as follows:

	Miles
Texas	7,800
Ohio	6,100
Pennsylvania	5,200
West Virginia	4,000
Oklahoma	3,700
Kansas	3,500
Louisiana	1,800
California	1,600
Arkansas	1,200
Kentucky	1,000
New York	1,000
Wyoming	900
Other	3,000
	40,800

A similar survey of oil lines in 1926 showed 44,470 miles of trunk lines and 45,700 miles of gathering lines, or a ratio of about 1:1.

As there are more than six times as many oil wells as there are gas wells, this ratio probably does not hold for natural-gas trunk and gathering lines, although the deficiency might be compensated by the gas-distributing lines, which are of much greater relative importance than oil-distributing lines.

As the above statement indicates, Texas was the leading State in gas trunk-line mileage, with Ohio second, Pennsylvania third, and West Virginia fourth. With respect to density or mileage per square mile, Ohio ranked first.

No data are available as to the natural-gas pipe-line mileage completed during 1929. Undoubtedly, however, the mileage laid during 1929 exceeded that laid during any previous year.

Among the large projects completed in 1929 were the following:

Field of origin	Approximate length (miles)	Destination
Monroe-Richland, La.	140	Shreveport, La.
Do [1]	450	Atlanta, Ga.
Do	450	St. Louis, Mo.
Lea, N. Mex	200	El Paso, Tex.
Bruni-Mirando, Tex	230	San Antonio, Tex.
Refugio, Tex	120	Do.
Panhandle, Tex	350	Dallas-Fort Worth, Tex.
Do	450	Kansas City, Mo.
Jennings, Tex	165	Monterrey, Mexico.
Kettleman Hills, Calif	300	San Francisco, Calif.
Do	100	San Joaquin Valley, Calif.
Baxter Basin, Wyo.-Hiawatha, Colo	250	Salt Lake City, Utah.
Clarksville, Ark	100	Little Rock, Ark.

[1] Branches to Jackson, Selma, Macon, Mobile, and other cities were either under way or contemplated at the end of 1929.

Among the projects under construction at the end of 1929 were the following:

Field of origin	Approximate length (miles)	Destination
Kettleman Hills, Calif	400	San Francisco-Sacramento, Calif.
Glendive, Mont	175	Williston, N. Dak.
Clarksville, Ark	400	Nashville, Tenn.
San Juan, N. Mex	200	Albuquerque-Santa Fe, N. Mex.
Medicine Lodge, Kans	360	Grand Island, Nebr.
Maljamar, N. Mex	140	Clovis, N. Mex.
Oklahoma City, Okla	60	Perry, Okla.
Atchison, Kans. (extension of old line)	60	Falls City, Nebr.
Lyons, Kans. (extension of old line)	120	Superior, Nebr.

Important lines contemplated but not actually in process of construction at the end of 1929 were:

Field of origin	Approximate length (miles)	Destination
Kettleman Hills, Calif	800	Oregon-Washington.
Ogden, Utah (extension)	125	Pocatello, Idaho.
Panhandle, Tex	950	Chicago, Ill.
Do	1,250	Indianapolis, Ind.
Los Angeles Basin, Calif	100	San Diego, Calif.
Glendive, Mont	250	Bismarck, N. Dak.
Do	600	Minneapolis-St. Paul, Minn.
Big Horn Basin, Wyo	260	Anaconda-Butte, Mont.
Hugoton, Kans	450	Omaha, Nebr.-Council Bluffs, Iowa.
Montana	700	Coeur d'Alene, Idaho-Spokane-Seattle, Wash.
Kentucky	300	Detroit, Mich.
West Virginia	400	Richmond, Va.-Washington, D. C.
Do	350	Philadelphia, Pa.

PHOSPHATE ROCK[1]

By BERTRAND L. JOHNSON[2]

GENERAL CONDITIONS

In 1929 the phosphate-rock industry of the United States enjoyed a continuation of the upward trend in domestic demand and showed a marked recovery in foreign demand, following the slight depression of 1928. In the domestic market the demand for both Florida and Tennessee phosphate rock increased, and greater quantities were mined and marketed in the Florida land-pebble and Tennessee fields in 1929 than in 1928. A further reduction in demand for western rock was shown by a slight falling off in the mine production and sales in the Western States. The declining foreign demand for Florida hard-rock phosphate resulted in the greatly decreased mine production and shipments of that type of product. In spite of the decreased production in the Western States and in the Florida hard-rock field, the total quantity of phosphate rock mined and marketed in 1929 exceeded that of the previous year because of increased productivity of the other fields. Stocks of phosphate rock in the hands of producers at the end of 1929 showed a gain over the tonnage on hand at the end of 1928.

Conditions in the export trade were varied. The general trends of the past few years in exports of both land pebble and hard rock continued—the trend for land pebble tending upward and that for hard rock tending downward. Total exports increased in both quantity and value, the sharp increase in the land-pebble exports far more than counterbalancing the decrease in the hard-rock exports. Imports were lower in quantity than in 1928 but were higher in value.

DOMESTIC MINE PRODUCTION

The quantity of phosphate rock mined in the United States in 1929 was 3,821,840 long tons, an increase of 298,610 tons, or 8.5 per cent, over 1928. The greater part (220,115 tons) of this increase was the result of increased production in Florida, where the quantity of phosphate rock mined was 7.6 per cent greater in 1929 than in 1928. The quantity of Florida hard rock mined decreased 46.9 per cent, whereas the quantity of land pebble mined increased 10.3 per cent. There was an increase of 79,664 tons, or 13.9 per cent, in the Tennessee mine production. The Western States showed a decrease of 1,169 tons, or 2.7 per cent, in the quantity of phosphate rock mined.

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[1] Work on manuscript completed December, 1930.

[2] The statistics on the domestic industry in this report were prepared by B. H. Stoddard and the data on imports and exports were compiled from the records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, both of the Bureau of Mines.

Phosphate rock mined in the United States, 1920–1929, by States, in long tons

Year	Florida	Kentucky	South Carolina	Tennessee	Western States	Total
1920	3, 255, 720	13, 208	42, 709	614, 474	48, 895	3, 975, 001
1921	2, 088, 251	15, 622		317, 340	4, 961	2, 426, 174
1922	2, 018, 809	12, 236		288, 330	17, 481	2, 336, 856
1923	2, 421, 571	18, 409		469, 011	34, 575	2, 943, 566
1924	2, 373, 530	3, 424		427, 614	40, 735	2, 845, 303
1925	2, 672, 650	14, 309	2, 147	480, 763	83, 802	3, 253, 671
1926	3, 064, 441	6, 097		475, 742	45, 742	3, 592, 022
1927	2, 543, 708			432, 610	48, 831	3, 025, 149
1928	2, 905, 826			573, 601	43, 803	3, 523, 230
1929	3, 125, 941			653, 265	42, 634	3, 821, 840

SALES OF DOMESTIC PHOSPHATE ROCK

The quantity of phosphate rock sold or used by producers in the United States in 1929 was greater than in any other year except the boom year 1920. The total value also was greater than that of any previous year except 1920. The quantity sold or used amounted to 3,760,855 long tons, an increase of 259,449 tons, or 7.4 per cent, over 1928. The total value was $13,153,259, an increase of $710,080, or 5.7 per cent, over 1928. The average selling value a ton for 1929 was $3.50, or 5 cents lower than the 1928 average.

Phosphate rock sold or used by producers in the United States, 1920–1929

Year	Long tons	Value	Year	Long tons	Value
1920	4, 103, 982	$25, 079, 572	1925	3, 481, 819	$11, 545, 678
1921	2, 064, 025	12, 270, 070	1926	3, 209, 976	10, 893, 800
1922	2, 417, 883	10, 482, 846	1927	3, 170, 699	11, 253, 352
1923	3, 006, 706	11, 576, 049	1928	3, 501, 406	12, 443, 179
1924	2, 867, 789	10, 252, 083	1929	3, 760, 855	13, 153, 259

DISTRIBUTION OF SALES BY USES

Sales of phosphate rock in 1928 and 1929 were made for a variety of uses. Among these may be mentioned the manufacture of superphosphates, phosphates, phosphoric acid, phosphorus, and ferrophosphorus; phosphorizing iron; direct application to the soil; and as an ingredient of stock and poultry feed.

The following figures, compiled from estimates made by the producing companies from their sales records, indicate the distribution of consumption by major uses in the United States.

Phosphate rock sold by producers in the United States for various uses, 1928 and 1929, in long tons

Use	1928	1929
Superphosphates	2, 348, 134	2, 249, 761
Phosphates, phosphoric acid, and ferrophosphorus	[1] 205, 630	[1] 321, 851
Direct application to the soil	[2] 42, 145	61, 224
Stock and poultry feed	4, 780	4, 791
Miscellaneous	15, 108	12, 903
	2, 615, 797	2, 650, 530

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[1] Includes small quantities used for phosphorus and for phosphorizing pig iron.

[2] Revised figures.

SUPERPHOSPHATES

The greater part of the phosphate rock sold in the United States goes into the manufacture of the various superphosphates. In 1929, 2,249,761 long tons of phosphate rock, or 85 per cent of the total sales, is reported to have been sold for this purpose. The indicated quantity so used, however, was somewhat less in 1929 than in 1928. The following domestic companies, covering nearly all those that made sales on the domestic market in 1929, sold rock for use in making superphosphates:

Amalgamated Phosphate Co., 535 Fifth Avenue, New York, N. Y. Mine at Brewster, Fla.

The American Agricultural Chemical Co., 420 Lexington Avenue, New York, N. Y. Mines near Pierce, Fla., and Spring Hill, Tenn.

Anaconda Copper Mining Co. (fertilizer department), Conda, Idaho. Mine at Conda, Idaho.

Armour Fertilizer Works, 111 West Jackson Boulevard, Chicago, Ill. Mines near Columbia, Tenn.

Charleston Mining Co., 627 East Main Street, Richmond, Va. Mines at Gordonsburg and Mountpleasant, Tenn.

Coronet Phosphate Co., 99 John Street, New York, N. Y. Mine at Plant City, Fla.

Federal Chemical Co., Fourth Street and Broadway, Louisville, Ky. Mine at Ridley, Tenn.

Hoover & Mason Phosphate Co., 8 South Michigan Avenue, Chicago, Ill. Mine at Mountpleasant, Tenn.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Mines near Mulberry, Fla., and Mountpleasant and Wales, Tenn.

The Phosphate Mining Co., 110 William Street, New York, N. Y. Mines at Bartow, Christina, and Nichols, Fla.

San Francisco Chemical Co., 112 Market Street, San Francisco, Calif. Mine at Montpelier, Idaho.

Southern Phosphate Corporation, Baltimore Trust Building, Baltimore, Md. Mines at Eaton Park and Lakeland, Fla.

Swift & Co., Union Stock Yards, Chicago, Ill. Mine near Fort Meade, Fla.

PHOSPHATES, PHOSPHORIC ACID, PHOSPHORUS, AND FERROPHOSPHORUS

The quantity of phosphate rock sold in 1929 for the manufacture of phosphates, phosphoric acid, phosphorus, and ferrophosphorus, and for phosphorizing iron was 321,851 long tons, an increase of about 57 per cent as compared with 1928. The companies reporting the production and sales of phosphate rock in 1929 for one or more of such purposes were:

Amalgamated Phosphate Co., 535 Fifth Avenue, New York, N. Y. Mine at Brewster, Fla.

The American Agricultural Chemical Co., 420 Lexington Avenue, New York, N. Y. Mine near Pierce, Fla.

Anaconda Copper Mining Co. (fertilizer department), Conda, Idaho. Mine at Conda, Idaho.

C. & J. Camp, Ocala, Fla. Mine near Dunnellon, Fla.

Charleston Mining Co., 627 East Main Street, Richmond, Va. Mines at Gordonsburg, Mountpleasant, and Wales, Tenn.

Coronet Phosphate Co., 99 John Street, New York, N. Y. Mine at Plant City, Fla.

Federal Chemical Co., Fourth Street and Broadway, Louisville, Ky. Mines at Century, Ridley, and Southport, Tenn.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Mines near Mulberry, Fla., and Mountpleasant and Wales, Tenn.

The Phosphate Mining Co., 110 William Street, New York, N. Y. Mines at Bartow, Christina, and Nichols, Fla.

Southern Phosphate Corporation, Baltimore Trust Building, Baltimore, Md. Mines at Eaton Park and Lakeland, Fla.

DIRECT APPLICATION TO THE SOIL

Statistics covering the sales of phosphate rock by producers for direct application to the soil are available since 1914. Sales for this purpose reached a maximum of 79,189 long tons in 1919, declined sharply in the 1921 business depression to 13,503 tons, and remained at low levels until 1925, when they increased to about 32,000 tons. In 1929 sales increased to 61,224 tons, a gain of 45 per cent over 1928. The 1929 sales were 77 per cent of the record sales of 1919.

Phosphate rock sold by producers in the United States for direct application to the soil, 1920–1929, in long tons

1920	72, 801	1925	31, 999
1921	13, 503	1926	29, 902
1922	16, 029	1927	32, 957
1923	10, 548	1928 (revised figures)	42, 145
1924	14, 320	1929	61, 224

Various types of phosphate rock were ground for direct application to the soil in 1929. By far the greater part came from Tennessee, but Florida, Idaho, Wyoming, and Montana also contributed. Although both the blue and the brown phosphate rock were utilized in Tennessee, most of the grinding plants employed a washed and dried brown rock. One of the producing companies ground brown phosphate rock after removal of some of the nonphosphatic material by air separation. In Florida land-pebble phosphate rock, phosphatic clay from the land-pebble district, and waste-pond phosphate from the hard-rock district were all used. The material used in the Western States was the unweathered rock phosphate of that region.

The producers of phosphate rock in 1929 for direct application to the soil were:

The American Agricultural Chemical Co., 420 Lexington Avenue, New York, N. Y. Plant at Pierce, Fla.

Anaconda Copper Mining Co. (fertilizer department), Conda, Idaho. Plant at Conda, Idaho.

S. W. Bach, 927 West Forty-first Drive, Los Angeles, Calif. Mine at Paris, Idaho.

Charleston Mining Co., 627 East Main Street, Richmond, Va. Plants at Gordonsburg and Mountpleasant, Tenn.

Cokeville Phosphate Co., Cokeville, Wyo. Plant at Cokeville, Wyo.

Hoover & Mason Phosphate Co., 8 South Michigan Avenue, Chicago, Ill. Plant at Mountpleasant, Tenn. Ground rock produced is all for account of Ruhm Phosphate & Chemical Co., Mountpleasant, Tenn.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Plant at Wales, Tenn.

Lakeland Phosphate & Fertilizer Co., Bartow, Fla. Plant at Bartow, Fla.

Natural Products Corporation, Ocala, Fla. Mine at Dunnellon, Fla.

The Phosphate Mining Co., 110 William Street, New York, N. Y. Plant at Nichols, Fla.

Tennessee-Illinois Phosphate Co., 137 South La Salle Street, Chicago, Ill. Plant at Twomey, Tenn. Sales company, Thomson Phosphate Co., 137 South La Salle Street, Chicago, Ill.

Washington Phosphate & Silver Co., Colfax, Wash. Mine at Maxville, Mont.

STOCK AND POULTRY FEED

The quantity of phosphate rock reported sold in 1929 for use as an ingredient of stock and poultry feed was 4,791 long tons, or practically the same as in 1928. Most of the rock sold for this purpose was Tennessee brown phosphate rock, but some sales of Florida land-pebble phosphate were also made. Companies reporting the production and sale of phosphate rock in 1929 for this use were the following:

Charleston Mining Co., 627 East Main Street, Richmond, Va. Mines at Gordonsburg and Mountpleasant, Tenn.

Hoover & Mason Phosphate Co., 8 South Michigan Avenue, Chicago, Ill. Mine at Mountpleasant, Tenn. Ground rock produced for account of Ruhm Phosphate & Chemical Co., Mountpleasant, Tenn.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Mine near Mulberry, Fla.

Tennessee-Illinois Phosphate Co., 137 South La Salle Street, Chicago, Ill. Mine and plant at Twomey, Tenn. Sales company, Thomson Phosphate Co., 137 South La Salle Street, Chicago, Ill.

STOCKS

Notwithstanding the large increase in sales in 1929, producers' stocks increased 53,330 tons. Total stocks in hands of producers on December 31, 1929, amounted to 860,530 long tons, of which about 690,000 tons was in Florida and 168,000 tons in Tennessee. In the Western States stocks on hand were very small. Stocks of wet phosphate rock in the United States were almost three times those of dry rock, and this ratio between wet and dry stocks held likewise for stocks in Florida and in Tennessee.

Total stocks in hands of producers at the end of 1929 equaled nearly three months' average shipments. Stocks of dry rock on hand, however, were only about three-fourths of an average month's shipments.

REVIEW BY STATES

In comparison with 1928, there was an increase in 1929 in both quantity and value of phosphate rock sold in Florida and Tennessee, but a decrease in both quantity and value in Idaho and Wyoming; Montana, in which no output was made in 1928, reported a small production in 1929. The average value of the phosphate rock sold in both Florida and Tennessee decreased 6 cents per ton from the 1928 average; the average value in the Western States was 5 cents per ton greater than in 1928.

Phosphate rock sold or used by producers in the United States, 1928 and 1929, by States

State	1928		1929	
	Long tons	Value	Long tons	Value
Florida:				
Hard rock	95,918	$383,672	72,424	$267,218
Land pebble	2,787,528	9,040,350	3,015,874	9,633,856
	2,883,446	9,424,022	3,088,298	9,901,074
Tennessee: Brown and blue rock	577,095	2,856,850	633,939	3,097,104
Western States:				
Idaho	37,477	147,908	35,899	141,931
Montana			40	400
Wyoming	3,388	14,399	2,679	12,750
	3,501,406	12,443,179	3,760,855	13,153,259

FLORIDA

Florida holds first place in the United States as a producer of phosphate rock and has held this position continuously since 1894, when it took the lead from South Carolina. It was the source of 82 per cent of the total phosphate rock sold or used by producers in the United States in 1929. The upward movement resumed in 1928, following declines in the two previous years, continued into 1929. The increase over 1928 was 7.1 per cent in quantity and 5.1 per cent in total value. The average value of $3.21 per ton in 1929, however, was 6 cents less than the average in 1928.

Land-pebble phosphate rock constituted 97.7 per cent of the total quantity of Florida phosphate rock marketed or used by producers in 1929, and hard-rock phosphate comprised the remaining 2.3 per cent.

The general trend of hard-rock production has been downward since 1907. In 1927 there was a slight reaction upward, but in 1928 the downward trend was again resumed and in 1929 production reached the lowest point since the World War. In comparison with 1928, the quantity of hard rock marketed in 1929 decreased 24.5 per cent and the total value decreased 30.4 per cent. On the basis of reports from the producing companies, the average value of the hard rock, f. o. b. mines, was $3.69 per ton in 1929 and $4 in 1928. The average export value of high-grade rock in 1929, calculated from statistics of the Bureau of Foreign and Domestic Commerce, was $7.01. The quotations for "phosphate rock, Florida, high-grade, hard, 77 per cent, mines," according to the Oil, Paint and Drug Reporter, remained at $6.50 per long ton throughout 1929.

The hard-rock deposits worked are in northwestern peninsular Florida near Hernando and Dunnellon and about 100 miles north of the land-pebble field. In mining these deposits the overburden is stripped by hydraulic methods and the hard-rock matrix is mined by dipper dredges, with 1½-cubic-yard buckets, operating in artificial ponds. The matrix is hauled by cable over trestles in 1-bucket-capacity cars to the washers on the edge of the pits, where the hard-rock phosphate is separated. The greater part of the washed product is shipped to Fernandina, a port on the east coast of Florida, where it is dried and shipped, mostly to European ports. One company sold hard rock in 1929 on the domestic market. The companies marketing hard rock in 1929 were:

J. Buttgenbach & Co., Dunnellon. Mines at Dunnellon and Hernando.
C. & J. Camp, Ocala. Mine near Dunnellon.
Mutual Mining Co., Savannah, Ga. Mine near Inverness.

Mining operations were in progress in 1929 at the indicated mines of the first two companies. The Mutual Mining Co. did no mining in 1929 but shipped hard rock from stock. The Natural Products Corporation, Ocala, reworked some abandoned waste ponds in the hard-rock district in 1929; its production is included in the hard-rock statistics.

Land-pebble phosphate rock constituted 97.7 per cent of the total Florida production in 1929, compared with 96.7 per cent in 1928. The marketed production in 1929 showed an increase of 8.2 per cent in quantity and 6.6 per cent in total value over 1928. The average value f. o. b. mines, according to reports from the various producers, was $3.19 per ton in 1929, 5 cents lower than in 1928. The marketed production of 3,015,874 long tons in 1929 was the highest land-pebble production ever reported, surpassing the former record of 1920. Land-pebble exports in 1929 were the greatest since 1913, the first year for which separate official figures for exports of land pebble were recorded; they constituted nearly 36 per cent of the 1929 marketed production of land-pebble phosphate rock.

The Florida land-pebble area of Polk and Hillsborough Counties remains by far the largest individual phosphate rock-producing district in the United States. The deposits are flat-lying unconsolidated sediments of Pliocene or later age, reconcentrations from the marine-planated phosphate-bearing Miocene limestone bedrock. The phosphate-bearing material, known locally as "matrix," variable in quantity and thickness, is overlain by variable thicknesses of sand or clay. The overburden is stripped either by drag-line excavators or by hydraulic methods. The matrix is mined entirely by hydraulicking. The material is washed down into sumps dug in the bedrock and is then pumped to washing plants near the pits. The concentrated wet phosphate rock from these washers is transported to the drying plants, where, after partial drying by drainage in wet storage piles, it is further dried in oil-fired direct-heat rotary driers. One company, the International Agricultural Corporation, used a flotation process in the recovery of finely divided phosphate in 1929.

In 1929 several companies reported production of land-pebble phosphate rock, as follows:

Amalgamated Phosphate Co., 535 Fifth Avenue, New York, N. Y. Mine at Brewster.

The American Agricultural Chemical Co., 420 Lexington Avenue, New York, N. Y. Mine near Pierce.

Coronet Phosphate Co., 99 John Street, New York, N. Y. Mines near Mulberry and at Pembroke and Plant City.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Mines near Mulberry.

The Phosphate Mining Co., 110 William Street, New York, N. Y. Mines at Bartow, Christina, and Nichols.

Southern Phosphate Corporation, Baltimore Trust Building, Baltimore, Md. Mines at Eaton Park and Lakeland.

Swift & Co., Union Stock Yards, Chicago, Ill. Mine near Fort Meade.

A few thousand tons of phosphatic sandy clay has been included with the land-pebble statistics. This material is mined at Bartow, in the land-pebble district, by the Lakeland Phosphate & Fertilizer Co., of Bartow, and is dried, ground, and shipped for direct application to the soil and for fertilizer filler.

Investigations of gravity concentration of the phosphatic sands of the land-pebble field were carried on in 1927, 1928, and 1929 by the United States Bureau of Mines in cooperation with certain Florida phosphate-rock companies, the Missouri School of Mines, and the University of Alabama. The results of this research work are published in two reports of the Bureau of Mines.[3]

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[3] Lawrence, H. M., and O'Meara, R. G., Gravity Concentration on Certain Florida Phosphatic Sands: Rept. of Investigations 3018, Bureau of Mines, 1930.

Lawrence, H. M., Increased Recoveries of Phosphate in the Land-Pebble District of Florida: Rept. of Investigations 3023, Bureau of Mines, 1930.

Florida phosphate rock sold or used by producers, 1920–1929

Year	Hard rock			Soft rock		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1920	400,249	$4,525,191	$11.31	13,953	$190,551	$13.66
1921	175,774	1,806,671	10.28	4,419	20,153	4.56
1922	188,084	1,308,201	6.96	446	3,500	7.85
1923	199,516	1,071,675	5.37	-----	-----	-----
1924	143,115	629,579	4.40	-----	-----	-----
1925	171,649	707,933	4.12	-----	-----	-----
1926	116,264	465,308	4.00	-----	-----	-----
1927	131,254	525,016	4.00	-----	-----	-----
1928	95,918	383,672	4.00	-----	-----	-----
1929	72,424	267,218	3.69	-----	-----	-----

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1920	2,955,182	$14,748,620	$4.99	3,369,384	$19,464,362	$5.78
1921	1,599,835	8,604,818	5.38	1,780,028	10,431,642	5.86
1922	1,870,063	7,035,821	3.76	2,058,593	8,347,522	4.05
1923	2,348,137	7,987,752	3.40	2,547,653	9,059,427	3.56
1924	2,289,466	7,387,897	3.23	2,432,581	8,017,476	3.30
1925	2,758,315	8,081,137	2.93	2,929,964	8,789,070	3.00
1926	2,591,943	8,218,200	3.17	2,708,207	8,683,508	3.21
1927	2,506,166	8,121,146	3.24	2,637,420	8,646,162	3.28
1928	2,787,528	9,040,350	3.24	2,883,446	9,424,022	3.27
1929	3,015,874	9,633,856	3.19	3,088,298	9,901,074	3.21

Quotations for Florida land-pebble phosphate rock at the end of 1929 are given in the following table. The rapid rise in the prices of phosphate rock from the lower to the higher grades is related not only to the increased total content of tricalcium phosphate (known to industry as "B. P. L." or "bone phosphate of lime") but reflects also an increased value per unit of tricalcium phosphate in the higher grades.

Prices of pebble phosphate per long ton, Florida[4]

Export prices (f. a. s.):		Domestic prices (f. o. b.):	
76 to 77 per cent	$7.15	76 to 77 per cent	$6.50
75 per cent	6.40	74 to 75 per cent	5.50
74 to 75 per cent	6.15	72 per cent	4.50
70 per cent	4.65	70 per cent	4.00
68 per cent	4.10		

TENNESSEE

Tennessee is the second largest producer of phosphate rock, ranking next to Florida, and has maintained this position since it passed South Carolina in 1899. The phosphate deposits at present worked are in the west-central part of the State. Two types of rock are now mined—"brown phosphate rock" and "blue phosphate rock." The brown phosphate rock is the residual weathered and leached outcrop of the phosphatic Ordovician limestones exposed over a wide area in the southern part of the central basin of Tennessee, where erosion of that basin in the summit of the Nashville dome has exposed the underlying Ordovician phosphatic limestones to weathering. The so-called blue phosphate rock is a thin, unweathered, highly phosphatic stratum of Devonian or Carboniferous (Mississippian) age occurring in the western part of the phosphate region.

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[4] Engineering and Mining Journal, Metal and Mineral Markets: Vol. 1, No. 1, Jan. 2, 1930, p. 9.

The overburden of the brown phosphate rock is clay and is removed at the larger operations with drag-line excavators. The rock itself is mined by drag-line excavators whenever possible. Where the phosphate is thin or lies in narrow channels ("cutters") in the limestone and can not be mined by the drag-line excavators, it is mined by pick and shovel. Steam shovels and hydraulic methods are no longer used for stripping or mining. The blue rock is mined by underground methods—drift mining by single-entry room-and-pillar system.

Most of the brown rock mined is washed later. Lump phosphate rock suitable for furnace use is either removed in the course of hand mining or is taken out by screens in the early stages of washing. The first step in the washing process is to disintegrate the material by thorough agitation (usually in log washers) with water. After all the clay and fine sand are in suspension the coarser phosphatic material is removed by screening. The next step is to separate the finer phosphatic grains from the clay in mechanical or hydraulic classifiers. The excess moisture in the wet rock from the washers is allowed to drain off in outdoor storage piles, and then the product is dried further in coal-fired direct-heat rotary driers.

The blue phosphate rock requires only crushing and drying before shipment.

With the exception of 1907, the tonnage of phosphate rock sold or used by producers in Tennessee in 1929 was the highest in the history of its phosphate rock-mining industry. The 1929 production of 633,939 long tons was less than 1 per cent below the record for annual output, as established in 1907.

About 93 per cent of the phosphate-rock production of Tennessee came from the brown-rock fields. The remainder is blue rock, of which the marketed production was 41,954 long tons in 1929, according to the report of the State of Tennessee Bureau of Mines, Department of Labor, Nashville, covering phosphate-rock operations in 1929. Only one mine was operated in the blue-rock field in 1929—the Mayfield mine at Gordonsburg.

In 1929, 13 phosphate rock-mining companies were operating in Tennessee, as follows:

The American Agricultural Chemical Co., 420 Lexington Avenue, New York, N. Y. Mine at Spring Hill.

Armour Fertilizer Works, 111 West Jackson Boulevard, Chicago, Ill. Mines near Columbia.

Charleston Mining Co., 627 East Main Street, Richmond, Va. Mines at Gordonsburg and Mountpleasant.

J. K. Davis, Mountpleasant. Mine at Mountpleasant.

Federal Chemical Co., Fourth Street and Broadway, Louisville, Ky. Mines at Century, Ridley, and Southport.

Harsh Phosphate Co., R. F. D. 7, East Station, Nashville. Mine near Nashville.

Hoover & Mason Phosphate Co., 8 South Michigan Avenue, Chicago, Ill. Mine at Mountpleasant.

International Agricultural Corporation, 61 Broadway, New York, N. Y. Mines at Mountpleasant and Wales.

J. J. Jones, Mountpleasant. Mine at Mountpleasant.

S. T. Jones, Mountpleasant. Mine at Mountpleasant.

Ligon & Huff, Mountpleasant. Mine at Southport.

George Owen, Mountpleasant. Mine at Mountpleasant.

Tennessee-Illinois Phosphate Co., 137 South La Salle Street, Chicago, Ill. Mine at Twomey.

Tennessee phosphate rock sold or used by producers, 1920–1929

Year	Brown rock			Blue rock			Total		
	Long tons	Value at mines		Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average		Total	Average
1920	542,725	$4,339,165	$8.00	78,671	$518,234	$6.59	621,396	$4,857,399	$7.82
1921	238,996	1,574,621	6.59	25,163	146,198	5.81	264,159	1,720,819	6.51
1922	329,949	1,951,539	5.91	9,078	51,803	5.71	339,027	2,003,342	5.91
1923	414,792	2,249,393	5.42	919	5,647	6.14	415,711	2,255,040	5.42
1924	367,319	1,894,422	5.16	21,378	81,766	3.82	388,697	1,976,188	5.08
1925	[1]464,240	[1]2,334,995	[1]5.03	(1)	(1)	(1)	464,240	2,334,995	5.03
1926	[1]455,395	[1]1,980,613	[1]4.35	(1)	(1)	(1)	455,395	1,980,613	4.35
1927	[1]481,769	[1]2,318,785	[1]4.81	(1)	(1)	(1)	481,769	2,318,785	4.81
1928	[1]577,095	[1]2,856,850	[1]4.95	(1)	(1)	(1)	577,095	2,856,850	4.95
1929	[1]633,939	[1]3,097,104	[1]4.89	(1)	(1)	(1)	633,939	3,097,104	4.89

[1] Blue rock included with brown rock.

WESTERN STATES

In 1929, as in 1928, the growth of the phosphate-rock industry in the Western States suffered a setback. These States usually furnish between 1 and 2 per cent of the total marketed production of the United States. In 1929 they supplied 1 per cent of the total.

The total quantity of phosphate rock sold or used by the producers of the Western States in 1929 was 38,618 long tons, a decrease of 5 per cent from the preceding year. Declines were registered both in Idaho and Wyoming. Idaho produced 35,899 tons in 1929, compared with 37,477 tons in 1928. Production in Wyoming was 2,679 tons in 1929, compared with 3,388 tons in 1928. Montana shipped 40 tons of phosphate rock in 1929, the first shipment since 1924.

The 1929 figures for the Western States are 69 per cent of the peak in 1920 and only 53 per cent of the maximum annual output of 72,631 tons in 1925. The average value per ton of the rock sold in 1929 increased to $4.02, a gain of 5 cents as compared with 1928.

Western States phosphate rock sold or used by producers, 1920–1929

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1920	55,609	$304,006	$5.47	1925	72,631	$319,498	$4.40
1921	6,291	25,872	4.11	1926	37,577	162,020	4.31
1922	4,481	19,692	4.39	1927	51,510	288,405	5.60
1923	30,335	175,713	5.79	1928	40,865	162,307	3.97
1924	38,570	194,569	5.04	1929	38,618	155,081	4.02

Five phosphate rock-producing companies were operating in the Western States in 1929—three in Idaho, one in Montana, and one in Wyoming. They were as follows:

Anaconda Copper Mining Co. (fertilizer department), Conda, Caribou County, Idaho.
S. W. Bach, 927 West Forty-first Drive, Los Angeles, Calif. Mine at Paris, Bear Lake County, Idaho.
San Francisco Chemical Co., 112 Market Street, San Francisco, Calif. Mine at Montpelier, Bear Lake County, Idaho.
Washington Phosphate & Silver Co., Colfax, Wash. Mine at Maxville, Granite County, Mont.
Cokeville Phosphate Co., Cokeville, Lincoln County, Wyo.

The western phosphate-rock deposits are oolitic phosphatic marine strata of Permian age. The productive beds are thick, 5 feet or more, and carry 30 per cent and more of phosphoric acid. The phosphate rock is mined by underground methods. The freshly mined rock is relatively dry, but some of the producers run it through a dryer before shipping. It is being used chiefly in the manufacture of superphosphates. The larger portion of the production—that from the Anaconda Copper Mining Co. phosphate mine at Conda, Idaho—is shipped to Anaconda, Mont., where it is made into treble superphosphate, phosphoric acid, and ammonium phosphate; a small part of the production from this property is ground for direct application to the soil. The production of the San Francisco Chemical Co. is shipped to California, where it is made into superphosphate. The product of the remaining companies is used for direct application to the soil.

OTHER STATES

Phosphate-rock deposits in the United States in the Carolinas, Kentucky, Arkansas, and other States have recently been unproductive. Kentucky and South Carolina, which have been the more important of these States, ceased producing in 1926 and 1925, respectively. The record of production for 10 years is given in the following table:

Kentucky and South Carolina phosphate rock sold or used by producers, 1920–1929

Year	Kentucky			South Carolina		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1920	13,452	$86,596	$6.44	44,141	$367,209	$8.32
1921	13,547	91,737	6.77			
1922	14,282	104,040	7.28	1,500	8,250	5.50
1923	13,007	85,869	6.60			
1924	7,941	63,850	8.04			
1925	12,837	94,064	7.33	2,147	8,051	3.75
1926	8,797	67,659	7.69			
1927–1929						

IMPORTS

Although the total quantity of phosphatic fertilizers imported into the United States was less in 1929 than in 1928, the total value of imports increased. Imports of crude phosphate rock decreased slightly and those of the bone-dust group decreased markedly, whereas those of basic slag and guano both increased, the imports of guano doubling.

The imports of crude phosphate rock into the United States in 1928 were the highest of any year since import statistics on this commodity have been available, except for a period of a few years (1898–1905) following the Spanish-American War, during which time the maximum annual importation of phosphate rock into the United States, 175,765 long tons, was reached. The quantity of crude phosphate rock imported in 1929 was less by 913 tons or 2 per cent than in 1928, although the value was 8.8 per cent higher. Eighty per cent of the phosphate rock imported into the United States in 1929 came from French possessions. Imports from French Morocco entered eastern United States (Baltimore) to the amount of 16,400 tons, 4,172 tons less than in 1928. Imports from French Oceania into the Hawaiian Islands in 1929 were 19,348 tons. Imports from Cuba into Porto Rico in 1929 were 6,000 tons, much smaller than in 1928. Curaçao, Netherland West Indies, shipped 2,250 tons to Charleston, S. C., by far the largest shipment for many years.

Phosphate rock, crude, imported into the United States, 1925–1929, by countries

[General imports]

Country	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	38	$7,836	13	$1,120	--------	--------	--------	--------	--------	--------
Canada	138	2,606	624	15,057	116	$3,222	104	$3,284	741	$14,144
Cuba	2,500	25,000	4,239	37,362	--------	--------	11,752	141,544	6,000	73,972
France	--------	--------	--------	--------	--------	--------	(1)	5	--------	--------
Germany	--------	--------	(1)	6	45	1,115	--------	--------	--------	--------
Japan	--------	--------	--------	--------	2	44	--------	--------	--------	--------
Morocco, French	1	12	--------	--------	10,641	48,635	20,572	103,199	16,400	96,102
Netherlands	--------	--------	--------	--------	--------	--------	--------	--------	160	2,060
Oceania:										
British	--------	--------	2	21	--------	--------	--------	--------	--------	--------
French	--------	--------	10,000	116,000	17,391	239,855	13,371	183,170	19,348	261,411
United Kingdom	58	2,478	2,500	23,045	--------	--------	--------	--------	--------	--------
West Indies: Netherland	--------	--------	--------	--------	--------	--------	13	36	2,250	21,482
	2,735	37,932	17,378	192,611	28,195	292,871	45,812	431,238	44,899	469,171

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[1] Less than 1 ton.

Phosphatic fertilizers (other than crude phosphate rock) imported for consumption in the United States, 1925-1929

Fertilizer	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Bone dust, or animal carbon, and bone ash, fit only for fertilizing	24,981	$724,473	46,715	$1,380,103	54,586	$1,540,897	82,460	$2,566,686	55,877	$1,624,483
Guano	17,407	730,046	11,673	430,203	23,321	898,205	22,584	1,046,834	45,905	2,202,709
Slag, basic, ground or unground	181	2,815	269	3,485	1,625	18,945	2,822	31,879	3,998	54,456

EXPORTS

PHOSPHATE ROCK

Total exports of phosphate rock from the United States in 1929 (1,142,746 long tons) were greater than for any year since 1913, when 1,366,508 tons was exported, and accounted for 30 per cent of the

1929 total marketed production of domestic phosphate rock. The increase over 1928 was 27 per cent in quantity. The sharp advance in the exports of land-pebble phosphate rock far more than compensated for the decline in the tonnage of high-grade hard rock exported. The total value of the exports, $5,386,919, was $933,818, or 21 per cent, greater than in 1928. The total value of the high-grade hard rock exported was lower than in 1928, but that of the land pebble exported in 1929 was much greater.

The general trend of the total phosphate-rock export tonnage from the United States since 1921 has been upward at a low but uniform rate of increase. Exports to Europe, after exhibiting a declining trend since 1920, also started upward in 1929.

Shipments of phosphate rock to Europe in 1929 amounted to 862,982 long tons, or 76 per cent of the total exports. Although the per cent of the total was the same as in 1928, the actual quantity exported to Europe showed an increase of 182,416 tons. Asia took 234,147 tons, or 20 per cent of the total exports in 1929, and North America 45,617 tons, or 4 per cent.

Germany was the best customer of the phosphate-rock industry of the United States in 1929, taking 268,684 tons, or 24 per cent of the total tonnage exported from the United States. Of this, 21,936 tons was high-grade hard rock and 246,748 tons was land-pebble phosphate. Japan ranked second, taking 230,548 tons (all land pebble), or 20 per cent of the total exports. Netherlands stood third with 15 per cent, Italy fourth with 11 per cent, and Spain fifth with 7 per cent.

High-grade hard-rock exports continued the irregular decline which started from the postwar peak of 1920 and were at the lowest level since 1918. Shipments of high-grade hard rock in 1929 (67,474 long tons) decreased 24.8 per cent from the 1928 exports. The smaller shipments of hard rock were due largely to the smaller demand from Germany, exports to that country decreasing 56 per cent from 1928. Declines were also registered in shipments to Belgium, Canada, and Netherlands, whereas increases occurred in shipments to Norway, Poland and Danzig, and Sweden.

Europe remains the leading market for high-grade hard rock, taking 95 per cent of the total high-grade hard rock exported from the United States in 1929; these shipments were all to northwestern Europe. North America (Canada and Mexico) took 5 per cent of the total.

The quantity of land-pebble and "other" phosphate rock exported in 1929 reached a new postwar record; it was also the highest since 1913, the first year for which separate official figures for land-pebble exports were recorded. The 1929 exports exceeded those of 1928 by 266,210 tons, or 32.9 per cent. Increases were recorded in exports to all countries to which exports had been made in 1928. In addition, land-pebble phosphate was exported to China, Estonia, France, Salvador, and Soviet Russia.

Seventy-four per cent of the land-pebble exports went to Europe, 22 per cent to Asia, and 4 per cent to North American countries. Germany was the leading land-pebble phosphate-consuming country and took 23 per cent of the total exports of this product. Japan was a close second, followed by Netherlands and Italy.

Phosphate rock, ground or unground, exported from the United States, 1920–1929

Year	High-grade rock		Land pebble		Other		Total	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1920	344,896	$4,496,457	693,355	$5,593,814	31,461	$479,904	1,069,712	$10,570,175
1921	182,594	2,592,541	544,425	4,627,875	6,293	99,721	733,312	7,320,137
1922	202,300	2,548,587	512,777	3,269,179	4,217	40,401	719,294	5,858,167
1923	194,339	2,477,501	630,565	3,273,006	2,647	21,664	827,551	5,772,171
1924	150,746	1,814,194	656,005	3,209,965	12,022	96,673	818,773	5,120,832
1925	158,985	2,283,076	697,891	3,287,370	13,324	107,317	870,200	5,677,763
1926	103,572	1,195,729	634,362	3,155,732	11,029	84,129	748,963	4,435,590
1927	128,774	888,732	[1]789,437	[1]3,842,830	(1)	(1)	918,211	4,731,562
1928	89,702	615,682	[1]809,062	[1]3,837,419	(1)	(1)	898,764	4,453,101
1929	67,474	473,031	[1]1,075,272	[1]4,913,888	(1)	(1)	1,142,746	5,386,919

[1] "Other" included with land pebble; not separately recorded.

Phosphate rock, ground or unground, not acidulated, exported from the United States, 1925–1929, by countries

HIGH-GRADE ROCK

Country	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Australia	-------	---------	12,500	$187,500	-------	---------	-------	---------	-------	---------
Belgium	28,000	$420,000	16,125	219,275	11,950	$81,820	9,000	$63,000	7,100	$48,700
Canada	1,490	7,826	2,443	10,784	1,145	6,747	3,559	26,488	3,140	25,517
France	-------	---------	-------	---------	1,050	7,350	-------	---------	-------	---------
Germany	90,374	1,284,285	23,525	232,775	94,725	653,495	49,318	331,419	21,936	153,831
Mexico	-------	---------	4	70	-------	---------	-------	---------	3	43
Netherlands	35,221	512,465	12,175	152,225	3,550	24,850	11,425	79,975	10,465	72,605
New Zealand	-------	---------	12,625	136,575	-------	---------	-------	---------	-------	---------
Nicaragua	-------	---------	-------	---------	4	20	-------	---------	-------	---------
Norway	-------	---------	2,100	36,500	4,200	29,400	2,100	14,700	2,200	15,400
Poland and Danzig	3,900	58,500	8,775	106,925	12,150	85,050	3,600	25,200	9,500	66,500
Sweden	-------	---------	13,300	113,100	-------	---------	10,700	74,900	13,130	90,435
	158,985	2,283,076	103,572	1,195,729	128,774	888,732	89,702	615,682	67,474	473,031

LAND PEBBLE[1]

Country	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Australia	-------	---------	36,236	$227,257	27,332	$165,492	-------	---------	-------	---------
Belgium	36,731	$184,338	43,551	220,443	20,716	104,186	25,492	$128,313	29,102	$141,765
British South Africa	21,592	117,456	13,513	75,297	10,380	59,685	-------	---------	-------	---------
Canada	12,957	65,987	14,060	74,832	17,848	104,173	18,666	119,519	25,244	192,222
China	-------	---------	-------	---------	-------	---------	-------	---------	3,599	12,597
Cuba	5,825	31,815	14,529	70,754	21,754	106,773	12,157	65,108	17,196	77,702
Czechoslovakia	-------	---------	-------	---------	-------	---------	3,000	15,300	-------	---------
Denmark	39,783	189,011	69,868	362,541	43,755	193,224	15,947	73,721	35,287	161,660
Estonia	-------	---------	-------	---------	-------	---------	-------	---------	3,600	12,600
Finland	-------	---------	-------	---------	9,269	50,426	-------	---------	-------	---------
France	3,310	15,343	-------	---------	-------	---------	-------	---------	2,200	6,622
Germany	92,946	529,072	65,559	338,440	125,661	693,367	166,931	803,549	246,748	1,110,183
Irish Free State	3,300	10,725	-------	---------	-------	---------	-------	---------	-------	---------
Italy	69,927	330,373	86,927	439,382	87,612	409,193	96,256	513,526	122,224	589,656
Japan	95,245	281,401	95,809	343,473	131,137	480,780	183,815	656,839	230,548	827,316
Latvia	-------	---------	-------	---------	12,139	63,198	12,206	62,885	16,228	75,957
Lithuania	-------	---------	-------	---------	-------	---------	3,994	24,963	7,510	44,060
Mexico	-------	---------	-------	---------	-------	---------	1	14	2	41
Netherlands	100,293	475,832	65,373	330,904	127,981	606,491	129,035	636,641	162,224	787,384
New Zealand	-------	---------	6,162	33,891	-------	---------	-------	---------	-------	---------
Norway	3,150	14,375	-------	---------	-------	---------	-------	---------	-------	---------
Poland and Danzig	10,900	69,315	3,139	19,776	25,204	155,943	22,337	128,097	39,129	217,644
Salvador	-------	---------	-------	---------	-------	---------	-------	---------	32	1,765
Soviet Russia in Europe	-------	---------	-------	---------	-------	---------	-------	---------	4,000	23,000
Spain	108,485	551,329	94,522	518,802	72,363	369,350	76,051	369,328	76,818	374,946
Sweden	61,233	294,504	5,839	32,115	29,794	175,466	29,160	178,921	32,325	161,631
United Kingdom	32,214	126,494	19,275	67,825	26,492	105,083	7,739	29,020	9,677	38,744
Yugoslavia and Albania	-------	---------	-------	---------	-------	---------	6,275	31,675	11,579	56,393
	697,891	3,287,370	634,362	3,155,732	789,437	3,842,830	809,062	3,837,419	1,075,272	4,913,888

[1] Classification for 1927, 1928, and 1929 reads "Land pebble and other"; not separately recorded.

Phosphate rock, ground or unground, not acidulated, exported from the United States, 1925–1929, by countries—Continued

ALL OTHER PHOSPHATE ROCK [1]

Country	1925		1926		1927		1928		1929	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	-------	---------	500	$2,000	(1)	(1)	(1)	(1)	(1)	(1)
Canada	13,324	$107,317	6,649	61,301						
Dominican Republic	-------	---------	60	200						
Netherlands	-------	---------	3,820	20,628						
	13,324	107,317	11,029	84,129	(1)	(1)	(1)	(1)	(1)	(1)

[1] Classification for 1927, 1928, and 1929 reads "Land pebble and other"; not separately recorded.

SUPERPHOSPHATES AND OTHER FERTILIZER MATERIALS

Exports of superphosphates in 1929 continued the decline begun in 1928. The quantity exported, however, was only 4 per cent less than in 1928. Most of the superphosphates exported went to three countries—Canada, Cuba, and Japan—Canada being the largest purchaser.

Fertilizers exported from the United States, 1920–1929

Year	Superphosphates (acid phosphates)		Prepared fertilizer mixtures		Nitrogenous fertilizer materials				All other fertilizers	
					Sulphate of ammonia		Other			
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1920	80,993	$2,949,629	(1)	(1)	(1)	(1)	(1)	(1)	205,666	$15,602,658
1921	4,278	96,303	(1)	(1)	(1)	(1)	(1)	(1)	55,239	2,602,277
1922	26,781	372,279	14,416	$690,972	147,331	$8,736,611	[2] 4,219	[2] $110,386	25,462	898,061
1923	42,099	534,446	17,997	832,948	153,677	11,117,726	13,291	614,814	45,073	1,921,972
1924	45,751	588,620	35,793	1,695,472	118,367	6,918,598	4,699	283,154	44,942	1,901,722
1925	65,779	988,914	29,923	1,530,354	123,141	6,748,728	6,802	367,435	46,509	1,985,335
1926	64,452	937,278	26,439	1,009,402	181,125	9,823,847	9,639	566,306	72,164	3,267,562
1927	107,507	1,615,466	14,720	617,582	138,692	6,826,600	8,951	492,004	82,962	3,440,961
1928	88,613	1,510,577	26,414	936,111	93,015	4,373,162	7,772	323,909	104,260	4,497,949
1929	85,118	1,489,476	33,508	1,795,918	144,761	6,295,519	24,358	1,229,995	89,936	3,660,160

[1] Not separately classified.
[2] Includes 2,556 tons of calcium cyanamid (lime of nitrogen), valued at $26,112; not separately classified or other years.

CONSUMPTION OF PHOSPHATE ROCK IN THE UNITED STATES

The table that accompanies this section shows the total annual apparent consumption of phosphate rock in the United States and also the annual apparent consumption of domestic phosphate rock. There is comparatively little difference between the two sets of figures, as imports are as yet relatively small, the home demand being largely satisfied from domestic production.

The greatest annual consumption of phosphate rock in the United States was in 1920, when a total of 3,034,333 long tons of phosphate rock was apparently consumed. The depression of 1921 cut the consumption over one-half, lowering it to 1,334,248 tons. There was a rapid increase in the amount consumed annually after this depression until 1925, when it reached 2,614,354 tons. After dropping off slightly for two years the apparent consumption advanced to 2,648,454 tons in 1928 and to 2,663,008 tons in 1929.

Phosphate rock consumed in the United States, 1920–1929, in long tons

Year	Marketed production	Imports	Exports	Apparent consumption	
				Total[1]	Domestic rock[2]
1920	4,103,982	63	1,069,712	3,034,333	3,034,270
1921	2,064,025	3,535	733,312	1,334,248	1,330,713
1922	2,417,883	5,890	719,294	1,704,479	1,698,589
1923	3,006,706	6,725	827,551	2,185,880	2,179,155
1924	2,867,789	16,098	818,773	2,065,114	2,049,016
1925	3,481,819	2,735	870,200	2,614,354	2,611,619
1926	3,209,976	17,378	748,963	2,478,391	2,461,013
1927	3,170,699	28,195	918,211	2,280,683	2,252,488
1928	3,501,406	45,812	898,764	2,648,454	2,602,642
1929	3,760,855	44,899	1,142,746	2,663,008	2,618,109

[1] Marketed production plus imports minus exports.
[2] Marketed production minus exports.

WORLD PRODUCTION

On the basis of reports covering about 97 per cent of the tonnage, the world production of phosphate rock in 1929 is estimated at about 10,400,000 metric tons, or about 300,000 tons more than the world production in 1928. Large increases were reported for French Morocco, where the gain was 271,170 tons, and for the United States, which showed a gain of 263,613 tons. The largest decrease in production in any individual country was that in Tunisia, where a decline of 278,000 tons from 1928 was reported.

As a result of decreased production in Tunisia and in Algeria, the French North African Colonies registered a net decrease in 1929. As compared with 1928, Tunisian production fell off 10 per cent and Algerian 15 per cent. The remaining French North African possession, French Morocco, continued the rise that began in 1921, and shipments in 1929 showed an increase of 271,170 tons over 1928.

France and its colonies, the United States, and the British Empire together produced 95 per cent of the world's production of phosphate rock in 1929. France and its colonies again led all other nations in phosphate-rock production, accounting for about 52 per cent of the total world production in 1929. The United States produced about 37 per cent and the British Empire about 6 per cent.

Of the individual countries in 1929, the United States was still the leading producer, exceeding Tunisia, second in output, by more than 1,300,000 tons, a much wider margin than in 1928. French Morocco retained third place, which it had taken from Algeria in 1927, with a marketed production now more than double that of the latter country. Algeria remained in fourth place, with Nauru and Ocean Islands in fifth.

The first and fifth largest individual phosphate rock-producing fields in the world are in the United States in Florida and Tennessee, respectively. The second, third, and fourth places are held by fields in the

French possessions in Tunisia, Morocco, and Algeria, respectively. By far the largest producing area is the Florida land-pebble phosphate-rock area. This field, which for many years was the leader, was surpassed in 1927 by the Tunisian field but regained its supremacy in 1928, and in 1929 increased its lead to more than 500,000 tons.

World production of phosphate rock, 1925-1929, by countries, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Algeria	815,116	929,355	919,108	875,947	747,035
Angaur Island [1]	66,921	63,922	64,141	65,358	65,494
Australia:					
New South Wales	203	257	132	138	71
South Australia	754	896	761	-----	-----
Victoria	-----	122	-----	-----	-----
Belgium	15,125	30,030	39,760	15,510	(2)
Canada	[3] 15	[3] 36	137	582	1,075
Christmas Island (Straits Settlements) [4]	111,835	131,057	118,553	113,687	121,926
Egypt	106,808	232,008	279,389	200,563	215,311
Estonia	2,040	4,054	3,576	6,858	8,352
France	230,496	252,168	184,921	(2)	(2)
Germany: [3]					
Bavaria	200	-----	-----	-----	-----
Prussia	123	542	443	-----	-----
India (British) [3]	1,504	730	613	818	22
Indo-China	30,236	14,511	20,700	19,629	18,772
Japan	87,375	108,569	75,386	58,776	14,573
Madagascar	449	6,135	6,480	8,450	13,441
Makatea Island [4]	81,061	127,177	135,666	136,306	242,990
Morocco, French	692,181	882,821	1,400,000	[5] 1,337,079	[5] 1,608,249
Nauru and Ocean Islands [6]	478,278	398,059	633,345	509,970	512,265
Netherland West Indies: Curaçao [4]	81,771	106,807	108,881	104,194	103,289
New Caledonia	12,000	[4] 10,647	9,000	7,000	(2)
Norway [3]	467	343	-----	-----	-----
Philippine Islands	7,528	7,512	705	1,550	1,492
Poland	(2)	(2)	(2)	16,000	38,508
Rumania	-----	-----	-----	-----	1,626
Russia [7]	39,824	72,516	56,460	[8] 27,500	[8] 45,000
Seychelles Islands [4]	3,259	6,935	11,329	15,408	12,789
Spain	5,315	5,656	4,202	7,897	7,626
Tunisia	2,691,000	2,568,000	3,075,000	2,789,000	2,511,000
United States (sold or used by producers)	3,537,702	3,261,496	3,221,589	3,557,604	3,821,217

[1] Exports during fiscal year ended March 31 of year following that stated.
[2] Data not available.
[3] Apatite.
[4] Exports.
[5] Shipments, including exports as follows: 1928, 1,323,293 tons; 1929, 1,591,933 tons.
[6] Exports during fiscal year ended June 30 of year stated.
[7] Year ended Sept. 30.
[8] Powdered.

SAND AND GRAVEL[1]

By Estelle R. Phillips[2]

PRODUCTION

The total output of sand and gravel reported as sold or used by producers in the United States in 1929 amounted to 222,571,905 short tons, valued at $132,835,979, an increase of 6 per cent in quantity and 11 per cent in value in comparison with 1928. Although the general increase shown is explained mainly by the record business demands during the first nine months of 1929, a minor proportion of the gain is accounted for by the very thorough canvass of the whole country for 1929, which gave more nearly complete figures and increased the number of companies reporting.

Although the record for the year shows a decrease in the quantity of building sand and gravel reported, there were increases of 16 and 22 per cent, respectively, in the quantity of sand and the quantity of gravel sold or used for paving and road making. There were increases, also, in gravel used for fills, railroad ballast, bank widening, and other purposes. The output of molding sand reported showed an increase of 30 per cent in quantity and 26 per cent in value over 1928. Cutting and grinding sand and fire or furnace sand also showed gains in both quantity and value. In comparison with 1928 glass sand reported decreased 4 per cent in quantity but increased 10 per cent in value, and engine sand and filter sand decreased in both quantity and value.

The total output of sand in 1929 amounted to 99,253,054 short tons, valued at $60,801,357, an increase of 2 per cent in quantity and 8 per cent in value as compared with 1928. The total output of gravel amounted to 123,318,851 short tons, valued at $72,034,622, an increase of 11 per cent in quantity and 14 per cent in value over 1928.

New York and Illinois, with outputs of 21,061,094 and 18,256,203 short tons, respectively, were the largest producers of sand and gravel in 1929. Other States that produced more than 10,000,000 tons each were as follows: Michigan, California, Ohio, Pennsylvania, Indiana, and Wisconsin. New York and Pennsylvania led the States in total value of output in 1929.

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[1] Work on manuscript completed January, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The total washed and screened sand and gravel sold or used by producers in 1929 amounted to 170,089,616 short tons, valued at $111,011,715. This quantity represents 76 per cent of the total sand and gravel produced. The ratio of washed and screened material to total output has ranged between 76 and 77 per cent since 1926 when statistics on this item were first collected by the Bureau of Mines.

Production was reported for approximately 2,900 plants and pits in 1929, as compared with 2,600 in 1928. Each of the following 11 States reported production from more than 100 plants and pits in 1929: New York, Illinois, Ohio, Michigan, California, Pennsylvania, Wisconsin, Indiana, New Jersey, Minnesota, and Washington. The canvass of certain aspects of the sand and gravel industry for 1929 made by the Bureau of the Census, Department of Commerce, was of material assistance to the Bureau of Mines in this study.

In addition to the sand sold or used by producers for the purposes listed in this report, other sand was finely ground or pulverized for use in paint, pottery, fillers, and other similar products. In 1929, 302,139 short tons of such finely ground or pulverized sand, valued at $2,039,144, was sold or used by producers in the United States. This subject is discussed in the chapter on "Silica" in Mineral Resources.

Sand and gravel sold or used by producers in the United States, 1920–1929

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	43,776,142	$39,198,614	38,265,246	$26,462,991	82,041,388	$65,661,605
1921	38,294,954	29,049,950	41,550,054	27,434,295	79,845,008	56,484,245
1922	49,694,923	35,469,920	45,172,123	29,147,744	94,867.046	64,617,664
1923	67,365,271	48,473,565	72,566,882	42,430,089	139,932,153	90,903,654
1924	75,572,010	48,844,465	80,658,053	48,168,650	156,230,063	97,013,115
1925	87,182,222	55,148,325	84,819,251	52,393,798	172,001,473	107,542,123
1926	92,114,279	55,675,988	90,986,539	55,662,713	183,100,818	111,338,701
1927	93,588,339	54,291,398	103,865,930	61,238,388	197,454,269	115,529,786
1928	97,737,717	56,132,406	111,381,151	63,075,531	209,118,868	119,207,937
1929	99,253,054	60,801,357	123,318,851	72,034,622	222,571,905	132,835,979

Sand and gravel sold or used by producers in the United States, 1928 and 1929, by uses

Use	1928		1929	
	Short tons	Value	Short tons	Value
Sand:				
Glass	2, 310, 828	$3, 435, 645	2, 219, 677	$3, 788, 471
Molding	4, 781, 765	5, 089, 969	6, 195, 343	6, 410, 343
Building	45, 629, 207	24, 116, 772	41, 161, 013	23. 309, 238
Paving	35, 244, 544	17, 305, 750	40, 801, 991	21, 131, 731
Grinding and polishing	1, 538, 046	1, 991, 962	1, 636, 464	2, 303, 652
Fire or furnace	305, 659	362, 044	440, 679	483, 551
Engine	2, 413, 043	1, 544, 204	2, 318, 931	1, 487, 906
Filter	113, 978	226, 896	100, 081	199, 838
Other [1]	5, 400, 647	2, 059, 164	4, 378, 875	1, 686, 627
	97, 737, 717	56, 132, 406	99, 253, 054	60, 801, 357
Gravel:				
Building	34, 747, 235	24, 071, 208	32, 448, 800	23, 813, 885
Paving	49, 088, 786	30, 697, 993	60, 029, 164	38, 695, 207
Railroad ballast [2]	27, 545, 130	8, 306, 330	30, 840, 887	9, 525, 530
	111, 381, 151	63, 075, 531	123, 318, 851	72, 034, 622
Grand total	209, 118, 868	119, 207, 937	222, 571, 905	132, 835, 979

[1] Includes some sand used for railroad ballast, fills, etc.

[2] Includes some gravel used by the railroads for fills and other purposes. The quantity of gravel reported as used exclusively for railroad ballast was as follows: 1928, 25,150,052 tons, valued at $7,832,871; 1929, 27,332,529 tons, valued at $8,804,082.

Sand and gravel sold or used by producers in the United States in 1928, by States and uses

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			(1)	(1)	558, 427	$174, 255	528, 827	$213, 555					(1)	(1)
Arizona					98, 175	90, 482	23, 640	22, 450					(1)	(1)
Arkansas	(1)	(1)	(1)	(1)	168, 191	110, 128	190, 720	132, 709	(1)	(1)	(1)	(1)	22, 407	$11, 781
California	(1)	(1)	67, 904	$100, 221	3, 973, 707	1, 955, 153	2, 631, 343	1, 152, 402	21, 145	$42, 701	22, 794	$29, 931	99, 115	36, 418
Colorado			(1)	(1)	234, 212	184, 521	71, 477	45, 785					27, 364	19, 650
Connecticut			438	1, 186	403, 585	275, 278	147, 992	86, 951	(1)	(1)				
Delaware			7, 960	4, 984	15, 607	12, 211	27, 800	15, 619	936	2, 340			7, 000	2, 400
District of Columbia					318, 696	175, 283	216, 065	118, 836					5, 402	2, 971
Florida					328, 256	154, 228	296, 613	135, 400					(1)	(1)
Georgia			3, 500	6, 500	185, 729	69, 193	450, 455	159, 232	15, 992	2, 566			2, 875	1, 857
Hawaii							3, 034	9, 102						
Idaho			(1)	(1)	6, 898	4, 934	10, 692	6, 437					(1)	(1)
Illinois	658, 036	$442, 923	698, 722	531, 468	4, 630, 189	2, 110, 951	3, 183, 271	1, 163, 281	399, 198	705, 895	31, 635	23, 406	128, 888	75, 131
Indiana	(1)	(1)	361, 740	202, 052	1, 928, 655	708, 998	1, 931, 304	913, 609	(1)	(1)	73, 380	29, 350	103, 220	37, 265
Iowa			64, 929	43, 667	531, 400	280, 843	1, 088, 377	450, 712	14, 087	31, 789			35, 608	17, 163
Kansas					1, 346, 266	783, 002	469, 556	242, 951					60, 121	30, 973
Kentucky			12, 684	22, 595	583, 588	568, 660	279, 434	164, 088			(1)	(1)	51, 974	32, 579
Louisiana					306, 291	166, 221	207, 391	78, 351					(1)	(1)
Maine					47, 150	48, 150	42, 872	27, 306	(1)	(1)			(1)	(1)
Maryland	(1)	(1)	(1)	(1)	465, 902	298, 051	924, 524	609, 617	(1)	(1)			(1)	(1)
Massachusetts	436	2, 451	35, 950	39, 591	1, 347, 309	1, 005, 498	178, 557	93, 642	5, 226	8, 433	(1)	(1)	38, 162	32, 996
Michigan	63, 546	145, 073	740, 428	323, 416	2, 258, 031	660, 966	3, 200, 533	1, 121, 334	(1)	(1)	(1)	(1)	(1)	(1)
Minnesota			19, 026	16, 924	741, 391	232, 971	537, 717	201, 248	(1)	(1)			50, 760	17, 257
Mississippi					232, 378	80, 514	112, 000	57, 325					1, 979	791
Missouri	145, 554	188, 960	95, 503	64, 814	1, 223, 547	722, 807	743, 642	490, 130	(1)	(1)			65, 010	47, 271
Montana					29, 347	18, 925	20, 618	19, 270					1, 994	218
Nebraska			1, 000	2, 000	545, 350	254, 506	119, 993	63, 103					29, 688	10, 229
Nevada	3, 585	7, 887	3, 104	9, 778			22, 829	18, 743						
New Hampshire							373, 222	97, 338					15, 000	3, 750
New Jersey	165, 142	246, 919	754, 581	998, 229	1, 340, 186	731, 551	1, 582, 954	774, 124	53, 736	155, 178	44, 824	57, 939	34, 139	13, 807
New Mexico					8, 721	6, 800	49, 629	22, 540	324	480			14, 832	11, 037
New York	(1)	(1)	550, 993	824, 429	8, 962, 122	4, 169, 686	4, 545, 193	2, 479, 199	(1)	(1)	(1)	(1)	142, 531	84, 395
North Carolina					329, 412	75, 330	127, 431	29, 985					53, 186	28, 110
North Dakota					34, 439	27, 776	3, 725	2, 525						
Ohio	63, 422	118, 570	782, 676	1, 094, 370	3, 009, 969	1, 810, 198	2, 455, 827	1, 459, 541	(1)	(1)	81, 160	154, 586	66, 762	50, 562
Oklahoma	(1)	(1)			341, 876	193, 865	638, 104	313, 829	200	100			23, 970	15, 771
Oregon					476, 737	324, 094	188, 600	121, 158					15, 437	6, 700

Pennsylvania	451, 014	906, 350	379, 493	561, 217	3, 900, 967	3, 106, 845	2, 610, 945	1, 913, 302	448, 859	509, 047	40, 809	54, 476	353, 582	382, 499
Rhode Island	-----	-----	(1)	(1)	4, 935	753	(1)	(1)	-----	-----	-----	-----	-----	-----
South Carolina	-----	-----	-----	-----	59, 353	26, 672	(1)	(1)	-----	-----	-----	-----	-----	-----
South Dakota	-----	-----	-----	-----	44, 117	26, 245	76, 461	42, 823	-----	-----	-----	-----	(1)	(1)
Tennessee	-----	-----	9, 105	7, 682	699, 719	487, 958	465, 279	285, 117	32, 534	30, 377	-----	-----	72, 718	45, 907
Texas	-----	-----	6, 700	20, 000	943, 144	638, 827	1, 061, 482	583, 952	5, 155	5, 725	-----	-----	91, 656	44, 443
Utah	-----	-----	-----	-----	26, 931	15, 845	48, 362	26, 688	-----	-----	-----	-----	(1)	(1)
Vermont	-----	-----	2, 236	559	1, 620	600	16, 053	10, 059	86, 800	31, 000	-----	-----	(1)	(1)
Virginia	35, 060	75, 945	23, 433	33, 202	226, 336	130, 326	354, 819	129, 058	17, 934	23, 256	(1)	(1)	124, 282	58, 963
Washington	-----	-----	1, 236	4, 389	661, 777	299, 266	484, 665	239, 847	-----	-----	-----	-----	40, 662	10, 624
West Virginia	527, 063	1, 068, 017	(1)	(1)	325, 258	301, 468	348, 056	322, 204	(1)	(1)	(1)	(1)	267, 207	235, 508
Wisconsin	-----	-----	85, 162	65, 289	1, 692, 044	574, 917	1, 853, 425	510, 555	38, 242	44, 824	-----	-----	162, 147	36, 522
Wyoming	-----	-----	-----	-----	31, 267	21, 021	96, 900	67, 000	-----	-----	-----	-----	(1)	(1)
Undistributed [2]	197, 970	232, 550	73, 262	111, 407	-----	-----	202, 136	61, 718	397, 678	398, 251	11, 057	12, 356	203, 365	138, 656
	2, 310, 828	3, 435, 645	4, 781, 765	5, 089, 969	45, 629, 207	24, 116, 772	35, 244, 544	17, 305, 750	1, 538, 046	1, 991, 962	305, 659	362, 044	2, 413, 043	1, 544, 204
Average value	-----	1. 49	-----	1. 06	-----	0. 53	-----	0. 49	-----	1. 30	-----	1. 18	-----	0. 64

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	-----	-----	(1)	(1)	686, 554	$458, 339	893, 537	$655, 640	(1)	(1)	3, 315, 985	$1, 719, 222
Arizona	-----	-----	-----	-----	(1)	(1)	(1)	(1)	(1)	(1)	566, 777	282, 996
Arkansas	-----	-----	(1)	(1)	37, 530	37, 498	586, 902	354, 544	533, 552	$246, 814	1, 683, 384	991, 408
California	5, 996	$11, 176	(1)	(1)	4, 035, 343	2, 619, 234	2, 984, 654	2, 079, 737	1, 449, 044	491, 755	15, 969, 132	8, 698, 884
Colorado	-----	-----	(1)	(1)	201, 812	153, 467	259, 435	189, 224	675	510	806, 051	605, 511
Connecticut	-----	-----	(1)	(1)	101, 130	102, 922	-----	-----	(1)	(1)	660, 708	479, 173
Delaware	5, 439	8, 025	2, 359	$2, 359	757	1, 136	757	1, 135	-----	-----	68, 615	50, 209
District of Columbia	-----	-----	-----	-----	277, 178	277, 178	184, 785	184, 785	-----	-----	1, 002, 126	759, 053
Florida	-----	-----	-----	-----	131, 074	95, 509	126, 521	107, 760	(1)	(1)	894, 879	495, 875
Georgia	108	648	39, 864	41, 573	18, 877	20, 887	27, 470	8, 035	78	78	744, 948	310, 569
Hawaii	-----	-----	-----	-----	-----	-----	536	1, 608	-----	-----	3, 570	10, 710
Idaho	-----	-----	-----	-----	22, 409	10, 753	395, 226	262, 854	(1)	(1)	716, 471	326, 278
Illinois	(1)	(1)	1, 814, 508	1, 022, 132	3, 182, 255	1, 573, 130	4, 475, 823	2, 069, 973	(1)	(1)	20, 969, 331	10, 243, 555
Indiana	-----	-----	(1)	(1)	1, 427, 388	942, 296	2, 657, 098	1, 599, 307	2, 211, 248	874, 303	11, 086, 331	5, 375, 058
Iowa	(1)	(1)	(1)	(1)	341, 533	333, 079	1, 013, 941	790, 344	234, 347	98, 928	3, 423, 619	2, 094, 955
Kansas	-----	-----	87, 097	34, 073	141, 404	62, 050	636, 830	373, 344	19, 003	6, 006	2, 760, 277	1, 532, 399
Kentucky	(1)	(1)	(1)	(1)	586, 652	489, 582	403, 137	258, 690	(1)	(1)	2, 100, 907	1, 589, 617
Louisiana	-----	-----	(1)	(1)	588, 935	516, 212	608, 495	386, 091	536, 940	328, 389	2, 310, 166	1, 503, 400
Maine	(1)	(1)	-----	-----	22, 152	34, 773	155, 866	90, 842	(1)	(1)	758, 528	348, 376
Maryland	-----	-----	-----	-----	221, 698	232, 689	908, 421	1, 123, 042	-----	-----	2, 602, 142	2, 409, 544
Massachusetts	4, 346	8, 058	(1)	(1)	912, 356	1, 035, 208	973, 639	671, 197	230, 614	68, 380	3, 751, 193	2, 986, 850

[1] Included under "Undistributed."

[2] Includes items entered as "(1)."

Sand and gravel sold or used by producers in the United States in 1928, by States and uses—Continued

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Michigan			655, 747	$112, 431	1, 959, 106	$1, 248, 623	4, 870, 352	$2, 582, 543	1, 965, 579	$605, 068	15, 893, 090	$6, 828, 431
Minnesota	(1)	(1)	(1)	(1)	712, 897	454, 761	946, 692	700, 166	1, 254, 752	362, 985	4, 409, 245	2, 029, 091
Mississippi					231, 424	123, 113	1, 720, 706	884, 015	713, 804	282, 790	3, 012, 291	1, 428, 548
Missouri			(1)	(1)	1, 180, 406	764, 236	885, 691	671, 440	761, 198	194, 219	5, 251, 226	3, 248, 813
Montana	55	$40	72, 579	18, 456	90, 516	72, 774	101, 694	96, 620	1, 114, 111	239, 072	1, 430, 914	465, 375
Nebraska	1, 960	1, 400	(1)	(1)	674, 186	405, 473	758, 871	495, 332	(1)	(1)	2, 234, 575	1, 265, 001
Nevada			18, 664	2, 052	(1)	(1)	28, 458	57, 736	(1)	(1)	201, 992	150, 966
New Hampshire					286, 402	58, 699	881, 997	798, 760	80, 000	60, 000	1, 636, 621	1, 018, 547
New Jersey	30, 039	87, 208	16, 373	15, 773	623, 938	608, 795	1, 619, 789	553, 241	26, 935	18, 626	6, 292, 636	4, 261, 390
New Mexico					883	1, 400	66, 383	53, 550	46, 467	15, 489	187, 239	111, 296
New York	21, 039	14, 903	51, 713	34, 447	4, 592, 179	3, 246, 724	1, 958, 857	1, 533, 211	268, 937	167, 830	21, 109, 864	12, 572, 634
North Carolina			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	971, 746	531, 092
North Dakota					58, 585	53, 204	106, 882	8, 394	421, 069	43, 301	624, 700	135, 200
Ohio	5, 485	13, 411	(1)	(1)	1, 969, 289	1, 391, 571	2, 613, 940	1, 710, 854	2, 782, 619	1, 009, 515	14, 286, 169	9, 116, 356
Oklahoma			(1)	(1)	218, 617	149, 424	823, 033	612, 526	735, 998	71, 764	2, 827, 810	1, 426, 258
Oregon			(1)	(1)	717, 321	388, 439	690, 112	480, 977	(1)	(1)	2, 441, 945	1, 453, 070
Pennsylvania			29, 164	22, 118	2, 885, 858	2, 529, 239	1, 792, 826	1, 290, 846	62, 273	13, 887	12, 955, 790	11, 289, 826
Rhode Island			840	150	(1)	(1)	159, 730	17, 870	(1)	(1)	192, 862	56, 610
South Carolina			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	507, 716	341, 391
South Dakota			(1)	(1)	16, 485	13, 570	2, 164, 054	1, 185, 782	148, 899	29, 041	2, 461, 963	1, 301, 075
Tennessee			30, 984	24, 738	586, 088	506, 118	964, 732	728, 813	78, 382	40, 805	2, 939, 541	2, 157, 515
Texas	(1)	(1)	(1)	(1)	1, 434, 366	1, 100, 788	1, 823, 635	1, 278, 990	2, 470, 746	869, 425	8, 007, 392	4, 602, 421
Utah					101, 617	58, 534	375, 255	345, 475	(1)	(1)	1, 000, 131	544, 020
Vermont			(1)	(1)	(1)	(1)	39, 590	24, 789	(1)	(1)	295, 524	108, 461
Virginia			93, 801	43, 397	206, 380	203, 139	442, 264	342, 209	(1)	(1)	1, 602, 444	1, 081, 948
Washington	(1)	(1)	(1)	(1)	1, 091, 783	403, 821	1, 620, 528	693, 814	1, 973, 683	337, 077	5, 917, 748	2, 001, 195
West Virginia					307, 820	276, 195	449, 969	418, 383	119, 507	79, 725	2, 383, 659	2, 773, 341
Wisconsin	(1)	(1)	(1)	(1)	1, 420, 901	595, 429	3, 333, 963	1, 478, 742	1, 437, 579	339, 867	10, 104, 015	3, 680, 420
Wyoming			(1)	(1)	36, 930	37, 289	187, 500	120, 000	(1)	(1)	1, 742, 880	414, 004
Undistributed [2]	39, 511	82, 027	2, 486, 954	685, 465	406, 221	383, 908	368, 210	324, 763	5, 867, 091	1, 410, 681		
	113, 978	226, 896	[3] 5, 400, 647	[3] 2, 059, 164	34, 747, 235	24, 071, 208	49, 088, 786	30, 697, 993	[4] 27, 545, 130	[4] 8, 306, 330	209, 118, 868	119, 207, 937
Average value		1.99		0.38		0.69		0.63		0.30		0.57

[1] Included under "Undistributed."

[2] Includes items entered as "(1)."

[3] Includes 2,536,623 tons of sand, valued at $704,511, used as railroad ballast, and 758,570 tons of sand, valued at $139,971, used by the railroads for fills, bank widening, and stock-car bedding.

[4] Includes some gravel used by the railroads for fills and other purposes. The quantity of gravel reported as used exclusively for railroad ballast was 25,150,052 tons, valued at $7,832,871.

Sand and gravel sold or used by producers in the United States in 1929, by States and uses

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			44,482	$37,662	516,646	$154,451	539,585	$228,240					(1)	(1)
Arizona					127,401	111,395	43,044	42,858					8,750	$2,888
Arkansas	(1)	(1)	(1)	(1)	266,554	148,568	363,903	210,272	(1)	(1)			20,971	8,842
California	7,500	$27,000	56,030	118,376	3,701,485	1,554,495	3,123,264	1,267,770	25,070	$58,646	19,073	$25,846	111,710	47,819
Colorado			11,645	9,265	215,785	113,674	20,640	11,236					26,665	15,031
Connecticut			(1)	(1)	332,972	208,434	246,562	192,126	2,373	9,106				
Delaware			6,149	4,532	17,017	11,395	23,000	12,000	134	689			10,000	4,000
District of Columbia					(1)	(1)	(1)	(1)					(1)	(1)
Florida	(1)	(1)			271,152	112,883	287,712	136,266					(1)	(1)
Georgia	10,470	11,517	11,840	2,920	246,984	95,243	269,165	83,542	(1)	(1)			18,293	6,864
Idaho					(1)	(1)	19,471	7,640					(1)	(1)
Illinois	552,539	502,434	1,135,820	804,371	4,011,481	1,573,236	2,020,278	822,156	449,475	901,145	65,795	54,768	142,864	75,307
Indiana	(1)	(1)	407,098	230,580	1,431,223	619,625	1,829,114	856,349	(1)	(1)	(1)	(1)	129,569	47,710
Iowa			48,558	32,911	442,491	224,833	1,294,148	538,416	(1)	(1)			44,338	22,146
Kansas			15,016	10,371	1,050,317	608,983	991,381	538,691	5,546	2,902			63,070	35,113
Kentucky			22,232	37,051	465,472	276,921	283,502	159,712			(1)	(1)	14,839	11,404
Louisiana					253,427	87,814	525,532	217,049	(1)	(1)			(1)	(1)
Maine					67,609	40,990	(1)	(1)					(1)	(1)
Maryland	(1)	(1)	(1)	(1)	409,473	209,228	1,311,231	858,682	(1)	(1)			(1)	(1)
Massachusetts	210	1,080	40,732	42,145	1,353,782	938,387	356,129	215,499	(1)	(1)	(1)	(1)	79,340	59,233
Michigan	(1)	(1)	1,150,807	305,447	1,941,452	800,116	3,152,125	1,239,397	(1)	(1)	(1)	(1)	17,998	3,938
Minnesota			27,919	23,259	968,369	346,239	554,310	219,604	(1)	(1)			64,323	20,525
Mississippi					212,494	153,435	242,311	118,642	(1)	(1)			(1)	(1)
Missouri	123,141	178,531	82,970	59,095	1,244,725	855,727	1,277,630	880,184	(1)	(1)			32,837	20,832
Montana			68	50	49,203	37,108	22,648	15,382					161	86
Nebraska			(1)	(1)	628,548	251,189	92,176	47,578					15,950	5,290
Nevada	(1)	(1)	(1)	(1)			(1)	(1)						
New Hampshire					(1)	(1)	439,297	144,162						
New Jersey	166,822	257,757	731,246	903,513	1,888,164	1,111,738	2,044,857	1,105,122	67,319	163,143	81,546	109,527	76,348	32,728
New Mexico					60,881	53,886	(1)	(1)	270	400			(1)	(1)
New York	(1)	(1)	591,866	984,077	6,590,182	4,233,415	6,438,889	3,882,774	2,513	2,963	(1)	(1)	186,286	121,691
North Carolina			(1)	(1)	136,930	60,512	199,794	46,463					68,968	39,116
North Dakota					52,057	26,854	(1)	(1)						
Ohio	74,666	184,424	977,441	1,357,075	2,636,704	1,733,778	2,444,878	1,405,580	(1)	(1)	60,069	107,992	75,043	45,721
Oklahoma	22,872	40,026			752,080	388,995	644,940	306,434	(1)	(1)			20,849	13,804
Oregon					274,799	242,161	292,689	217,525					(1)	(1)

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[1] Included under "Undistributed."

Sand and gravel sold or used by producers in the United States in 1929, by States and uses—Continued

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Pennsylvania	506,812	$1,011,063	432,632	$647,879	3,452,533	$3,300,615	2,426,304	$2,110,870	570,717	$664,910	101,373	$133,123	328,012	$355,027
Rhode Island	--------	--------	(1)	(1)	27,434	8,187	71,784	24,503	(1)	(1)	--------	--------	--------	--------
South Carolina	--------	--------	--------	--------	116,233	30,237	304,209	98,169	(1)	(1)	--------	--------	(1)	(1)
South Dakota	--------	--------	--------	--------	58,529	32,380	91,770	22,199	--------	--------	--------	--------	1,407	705
Tennessee	--------	--------	10,464	8,958	542,181	336,662	580,924	353,940	48,961	37,182	(1)	(1)	38,834	30,084
Texas	1,500	487	3,320	10,835	1,114,952	637,394	1,485,330	792,514	235	625	--------	--------	78,344	35,443
Utah	--------	--------	--------	--------	111,732	56,661	55,672	30,834	--------	--------	--------	--------	--------	--------
Vermont	--------	--------	2,284	457	(1)	(1)	26,821	24,245	(1)	(1)	--------	--------	(1)	(1)
Virginia	70,101	145,990	17,816	29,609	172,650	104,808	477,893	184,932	13,349	14,582	(1)	(1)	131,697	63,395
Washington	--------	--------	1,540	5,034	668,057	366,497	304,864	139,153	--------	--------	--------	--------	67,672	34,134
West Virginia	498,729	1,049,281	(1)	(1)	345,490	322,554	379,627	344,645	(1)	(1)	--------	--------	251,156	210,174
Wisconsin	--------	--------	128,597	82,508	1,471,019	469,327	2,155,460	810,911	33,347	73,132	(1)	(1)	57,912	14,306
Wyoming	--------	--------	--------	--------	(1)	(1)	(1)	(1)	--------	--------	--------	--------	(1)	(1)
Undistributed [3]	184,315	378,881	236,771	662,363	462,344	258,208	1,047,628	167,465	417,155	374,227	112,823	52,295	134,725	104,550
	2,219,677	3,788,471	6,195,343	6,410,343	41,161,013	23,309,238	40,801,991	21,131,731	1,636,464	2,303,652	440,679	483,551	2,318,931	1,487,906
Average value	--------	1.71	--------	1.03	--------	0.57	--------	0.52	--------	1.41	--------	1.10	--------	0.64

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	400	$1,600	(1)	(1)	501,882	$304,569	699,106	$492,786	32,140	$4,660	2,371,545	$1,229,424
Arizona	--------	--------	556	$133	105,211	103,810	(1)	(1)	(1)	(1)	395,386	329,116
Arkansas	--------	--------	(1)	(1)	187,216	176,976	1,293,636	741,859	1,796,688	478,150	3,992,336	1,851,755
California	5,131	11,742	187,066	78,322	3,616,853	2,313,223	3,879,523	2,607,987	955,840	260,037	15,688,545	8,371,263
Colorado	--------	--------	4,598	2,008	259,512	194,153	171,859	105,028	272,162	42,192	982,866	492,587
Connecticut	540	337	84,769	38,709	92,275	93,388	83,873	17,222	(1)	(1)	850,390	566,410
Delaware	(1)	(1)	7,936	13,215	592	888	(1)	(1)	--------	--------	78,055	59,266
District of Columbia	--------	--------	--------	--------	(1)	(1)	(1)	(1)	--------	--------	(1)	(1)
Florida	--------	--------	(1)	(1)	117,050	98,432	73,483	55,269	20,751	16,808	788,298	422,409
Georgia	315	1,733	10,762	4,739	7,392	8,485	(1)	(1)	(1)	(1)	604,611	235,299
Idaho	--------	--------	(1)	(1)	46,021	28,932	140,397	125,403	396,925	57,272	661,993	243,173

Illinois	1,053	4,212	1,048,439	534,136	3,401,945	1,589,935	3,363,578	1,564,304	2,062,936	645,234	18,256,203	9,071,238
Indiana	(1)	(1)	465,111	112,749	1,144,734	749,303	2,907,477	1,820,461	2,457,721	1,028,953	10,901,798	5,528,832
Iowa	(1)	(1)	39,068	8,691	317,719	254,666	1,600,895	973,893	237,716	115,146	4,043,609	2,211,752
Kansas	1,472	1,976	78,486	36,342	108,965	56,783	914,149	556,002	161,381	32,736	3,389,783	1,879,899
Kentucky			(1)	(1)	481,291	294,349	898,947	742,434	(1)	(1)	2,350,430	1,581,501
Louisiana			45,086	18,812	578,054	502,802	1,114,748	901,748	605,943	333,178	3,138,673	2,069,024
Maine					120,491	121,801	1,534,666	135,994	412,666	93,756	2,861,271	447,140
Maryland					299,077	302,922	1,095,454	1,346,605	(1)	(1)	3,193,486	2,853,617
Massachusetts	2,328	4,556	4,822	6,144	858,139	971,277	1,736,237	1,104,276	664,102	144,322	5,114,188	3,503,576
Michigan			548,312	127,883	2,533,588	1,425,565	5,139,278	2,969,864	2,177,970	860,525	16,844,099	7,928,744
Minnesota	(1)	(1)	(1)	(1)	629,310	583,839	1,223,437	919,314	1,482,348	275,407	4,990,256	2,412,776
Mississippi					129,384	91,681	1,636,994	733,642	535,729	178,130	2,766,036	1,277,746
Missouri			(1)	(1)	829,630	632,667	1,578,684	1,275,175	421,012	213,635	5,775,729	4,291,164
Montana			113,065	28,363	332,436	150,751	62,440	37,710	1,866,401	398,377	2,446,422	667,827
Nebraska			(1)	(1)	1,087,975	643,746	1,211,342	822,898	320,204	81,132	3,370,513	1,857,065
Nevada					(1)	(1)	666,691	425,663	711,199	68,972	1,403,255	605,079
New Hampshire					38,254	31,707	1,119,515	968,379	(1)	(1)	1,976,781	1,223,371
New Jersey	30,039	80,725	12,723	11,136	752,762	930,241	856,166	864,378	14,006	15,277	6,721,498	5,585,285
New Mexico					59,321	62,820			203,166	49,269	337,768	177,368
New York	(1)	(1)	164,457	77,652	3,362,441	2,900,439	3,291,876	2,595,089	423,570	111,927	21,061,094	14,919,658
North Carolina			91,863	58,464	(1)	(1)	179,878	170,530	74,459	41,981	1,004,858	1,020,533
North Dakota					72,312	67,879	66,382	5,808	(1)	(1)	493,411	133,621
Ohio	(1)	(1)	258,044	54,494	1,807,360	1,220,046	3,085,107	1,786,631	2,788,582	1,109,650	14,250,141	9,182,862
Oklahoma	1,300	3,900	(1)	(1)	222,559	157,746	927,089	545,297	197,579	142,483	2,904,897	1,612,755
Oregon			(1)	(1)	486,100	347,344	940,884	608,053	250,215	89,692	2,257,338	1,508,787
Pennsylvania			(1)	(1)	2,966,015	3,107,532	1,848,278	2,292,593	(1)	(1)	12,674,320	13,658,328
Rhode Island					49,629	21,785	132,357	54,945			301,533	154,390
South Carolina	(1)	(1)	(1)	(1)	(1)	(1)	136,059	151,762	264,631	167,087	1,068,005	602,432
South Dakota			6,739	2,308	26,218	23,922	2,112,700	398,387	431,908	98,303	2,729,271	578,204
Tennessee			(1)	(1)	407,383	261,723	1,361,957	1,017,802	(1)	(1)	3,089,500	2,086,535
Texas	7,950	16,279	353,915	139,957	1,327,648	1,079,546	2,971,979	2,126,303	2,064,122	926,560	9,409,295	5,765,943
Utah			(1)	(1)	105,154	59,013	857,052	478,140	(1)	(1)	1,588,305	722,971
Vermont			10,676	4,859	4,320	4,596	13,221	6,459	(1)	(1)	170,301	58,879
Virginia			98,958	47,877	155,161	145,336	445,989	339,252	(1)	(1)	1,728,590	1,165,358
Washington			55,054	13,906	800,257	387,805	1,795,377	942,645	1,698,872	248,845	5,391,693	2,138,019
West Virginia			(1)	(1)	410,852	351,934	519,403	431,588	213,777	132,771	2,667,940	2,893,542
Wisconsin	(1)	(1)	(1)	(1)	1,123,842	481,522	3,880,484	2,110,533	1,806,477	501,140	10,727,632	4,574,182
Wyoming					(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed [2]	49,553	72,778	688,370	265,728	484,470	476,006	460,517	325,096	2,817,689	561,923	2,757,958	1,085,274
	100,081	199,838	[3]4,378,875	[3]1,686,627	32,448,800	23,813,885	60,029,164	38,695,207	[4]30,840,887	[4]9,525,530	222,571,905	132,835,979
Average value		2.00		0.39		0.73		0.64		0.31		0.60

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[1] Included under "Undistributed."

[2] Includes items entered as "(1)."

[3] Includes 2,505,408 tons of sand, valued at $703,891, used for railroad ballast, some sand used by the railroads and others for fills, bank widening, and stock-car bedding, and some miscellaneous material.

[4] Includes some gravel used by the railroads for fills and other purposes. The quantity of gravel reported as used exclusively for railroad ballast was 27,332,529 tons, valued at $8,804,082.

VALUES

There was a general upward trend in 1929 in the average values f. o. b. plant or pit for each class of material, with the exception of molding sand and fire or furnace sand which decreased and engine sand which remained the same as in 1928.

The average value for the total output sold or used by producers was 60 cents per short ton in 1929, compared with 57 cents in 1928, 59 cents in 1927, and 61 cents in 1926. The washed and screened sand and gravel, considered alone, averaged 65 cents a ton in 1929, a gain over the average of 61 cents in 1928, 62 cents in 1927, and 64 cents in 1926. The average values per ton for glass sand, building sand, and railroad ballast gravel—$1.71, 57 cents, and 31 cents, respectively—were the same as those for 1924. The average of $2 per ton for filter sand was a gain of 1 cent over 1928 and a loss of 1 cent from the average for 1924. In general, the 1929 average realizations for the individual classes of material resembled more those in 1924 than those in the years 1925 to 1928.

Average value per short ton of sand and gravel sold or used by producers in the United States, 1920–1929

[Based on amounts received for sales f. o. b. pits or nearest shipping points]

Kind	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Glass sand	$2.19	$1.81	$1.62	$1.84	$1.71	$1.64	$1.59	$1.50	$1.49	$1.71
Molding sand	1.46	1.29	1.17	1.21	1.13	1.08	1.06	1.06	1.06	1.03
Building sand	.68	.65	.60	.61	.57	.58	.55	.54	.53	.57
Paving sand	.68	.63	.61	.59	.56	.55	.54	.50	.49	.52
Grinding and polishing sand	1.80	1.61	1.46	1.62	1.54	1.38	1.35	1.30	1.30	1.41
Fire or furnace sand	1.81	1.56	1.42	1.45	1.23	1.14	1.06	1.10	1.18	1.10
Engine sand	.82	.86	.76	.76	.66	.62	.61	.63	.64	.64
Filter sand	1.27	1.11	1.99	1.20	2.01	2.34	2.13	2.08	1.99	2.00
Railroad ballast gravel[1]	.32	.33	.36	.29	.31	.33	.34	.33	.30	.31
Gravel (exclusive of railroad ballast)	.81	.75	.72	.72	.70	.70	.70	.69	.65	.68
All sand and gravel	.80	.71	.68	.65	.62	.63	.61	.59	.57	.60

[1] Includes some gravel used by the railroads for fills and other purposes. The average value per ton for the gravel used exclusively for railroad ballast was $0.31 in 1928 and $0.32 in 1929.

GLASS SAND

The production of glass sand in 1929 amounted to 2,219,677 short tons, valued at $3,788,471, a decrease of 4 per cent in quantity but an increase of 10 per cent in value as compared with 1928. Glass sand was produced in 1929 in 19 States, of which the largest producers, listed in order of quantity, were Illinois, Pennsylvania, West Virginia, New Jersey, and Missouri. The output of glass sand in these States ranged from 552,539 short tons in Illinois to 123,141 tons in Missouri. West Virginia, Pennsylvania, Illinois, New Jersey, Ohio, and Missouri led in total value of glass sand produced, the total ranging from $1,049,281 in West Virginia to $178,531 in Missouri.

The average value per short ton f.o.b. plant or pit for the total output of glass sand in 1929 was $1.71, the same as that for 1924 and a sharp gain over the average of $1.49 in 1928. Since 1924 the trend in average value has been downward, except in 1929. The average value for the total glass sand output of the individual States in 1929 ranged from 32 cents to $5.95 a short ton, compared with a range from 25 cents to $5.62 in 1928.

Glass sand sold or used by producers in the United States, 1920–1929

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1920	2,165,926	$4,748,690	$2.19	1925	2,334,921	$3,836,085	$1.64
1921	1,280,359	2,314,314	1.81	1926	2,274,218	3,615,371	1.59
1922	1,768,549	2,866,366	1.62	1927	2,171,693	3,257,790	1.50
1923	2,034,958	3,751,778	1.84	1928	2,310,828	3,435,645	1.49
1924	2,169,899	3,718,973	1.71	1929	2,219,677	3,788,471	1.71

MOLDING SAND

The figures for molding sand in 1929—6,195,343 short tons, valued at $6,410,343—showed increases of 30 per cent in quantity and 26 per cent in value as compared with 1928. The production of more than 6,000,000 tons in 1929 set a new record; in only three other years (1920, 1923, and 1926) has the output exceeded 5,000,000 tons. The total value of the production in both 1920 and 1923, however, exceeded that in 1929.

Molding sand was reported from 33 States in 1929. The leading producing States, in order of quantity, were Michigan, Illinois, Ohio, New Jersey, and New York, the output of these States ranging from 1,150,807 tons in Michigan to 591,866 tons in New York. The States leading in total value of molding sand were Ohio, New York, New Jersey, Illinois, and Pennsylvania, the value of the output in these States ranging from $1,357,075 in Ohio to $647,879 in Pennsylvania.

The average value per ton f. o. b. plant or pit for the total output of molding sand was $1.03 in 1929, compared with $1.06 in each of the three preceding years. The average value for the total molding sand output of the individual States in 1929 ranged from 20 cents to $3.29 a short ton.

Molding sand sold or used by producers in the United States, 1920–1929

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1920	5,128,075	$7,504,759	$1.46	1925	4,995,428	$5,400,618	$1.08
1921	1,906,977	2,451,966	1.29	1926	5,309,166	5,630,799	1.06
1922	3,839,116	4,478,405	1.17	1927	4,194,975	4,458,508	1.06
1923	5,559,644	6,730,417	1.21	1928	4,781,765	5,089,969	1.06
1924	4,403,893	4,995,268	1.13	1929	6,195,343	6,410,343	1.03

IMPORTS

Imports of sand and gravel for consumption in the United States, as recorded by the Bureau of Foreign and Domestic Commerce, amounted to 1,666,387 short tons, valued at $751,602, in 1929, an increase of 111 per cent in quantity and 92 per cent in value as compared with 1928. No imports of glass sand were recorded for 1929, but imports of material classified as "Other sand" increased from 385,848 short tons, valued at $189,072, in 1928 to 1,106,974 tons, valued at $446,259, in 1929. Imports of gravel also increased—from 359,237 short tons, valued at $167,350, in 1928 to 559,413 tons, valued at $305,343, in 1929.

From the accompanying table on "general" imports of sand and gravel, by countries, it will be seen that Canada was the source of 91 per cent of the sand and gravel imported in 1929. Belgium supplied 5 per cent of the total, Mexico 3 per cent, and British India, Germany, France, Netherlands, the United Kingdom, and Norway the remainder.

The values given for imports represent the foreign market value (or the export value, if higher) plus the cost of containers and all expenses incident to placing merchandise ready for shipment to the United States, including the export tax, if any.

Sand and gravel imported for consumption in the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	1,226,684	$912,282	1925	534,555	$233,422
1921	906,905	771,734	1926	947,579	341,911
1922	451,943	238,386	1927	736,271	302,551
1923	477,762	259,820	1928	788,222	392,111
1924	701,410	280,206	1929	1,666,387	751,602

Sand and gravel imported for consumption in the United States, 1927–1929, by classes

Class	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
Glass sand	10,665	$8,712	43,137	$35,689		
Other sand	411,797	189,527	385,848	189,072	1,106,974	$446,259
Gravel	313,809	104,312	359,237	167,350	559,413	305,343
	736,271	302,551	788,222	392,111	1,666,387	751,602

Sand and gravel imported into the United States, 1927–1929, by countries

[General imports]

Country	1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Bermuda	1	$4				
Canada	622,872	211,522	690,358	$261,805	1,539,883	$625,385
Dominican Republic			2	50		
Mexico	32,059	7,780	9,453	6,808	54,656	15,511
South America: Brazil			58	2,666		
Europe:						
Belgium	76,293	47,684	81,089	70,705	87,457	65,019
Czechoslovakia	24	153				
France	788	7,348	1,098	6,848	1,214	10,948
Germany	352	110	6	199	1,786	1,922
Italy			2	21		
Netherlands	748	8,191	1,139	8,323	519	5,916
Norway					1	5
Sweden			29	159		
United Kingdom	2,325	5,819	339	2,246	296	2,520
Asia:						
China					(1)	8
India (British)	805	13,915	4,647	32,257	2,573	24,363
Japan	3	22	1	14		
Palestine			1	10		
Africa: Liberia					(1)	5
Oceania: Australia	1	3				
	736,271	302,551	788,222	392,111	1,688,385	751,602

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[1] Less than 1 ton.

EXPORTS

Exports of sand and gravel in 1929 amounted to 486,378 short tons, valued at $809,831, a decrease of 34 per cent in quantity but an increase of 27 per cent in value as compared with 1928.

Sand and gravel exported from the United States, 1920–1929

Year	Short tons	Value	Year	Short tons	Value
1920	(1)	$669,945	1925	425,612	$496,050
1921	(1)	379,982	1926	424,374	610,023
1922	356,520	400,199	1927	421,243	557,644
1923	551,233	598,633	1928	737,368	638,288
1924	314,140	401,662	1929	486,378	809,831

[1] Quantity not recorded prior to 1922.

MICA[1]

By B. H. STODDARD[2]

PRODUCTION

The total quantity of uncut mica sold by producers in the United States in 1929 was 7,271 short tons, valued at $404,222. Of this total 1,018 tons (2,035,128 pounds), valued at $286,321, was sheet mica, comprising 1,731,096 pounds of punch mica, valued at $97,344; 283,084 pounds of mica larger than punch, valued at $187,332; and 20,948 pounds of uncut splittings, valued at $1,645. In addition, 6,253 tons of scrap mica, valued at $117,901, was sold in 1929.

In comparison with 1928 the figures for punch mica indicate an increase of 18 per cent in quantity and 7 per cent in value and those for mica larger than punch an increase of 33 per cent in quantity and 34 per cent in value; sales of uncut splittings showed large gains in both quantity and value. The total sales of uncut sheet mica, including punch, larger than punch, and splittings, increased 21 per cent in quantity and 24 per cent in value. Figures for scrap mica indicate decreases from 1928 of 19 per cent in quantity and 11 per cent in value.

In 1929, as usual, the chief producing States were New Hampshire and North Carolina. Sales were also made in 1929 from eight other States, as follows: Alabama, Colorado, Connecticut, Georgia, Maine, New Mexico, South Dakota, and Virginia.

The statistics for "mica" in this report cover only muscovite or white mica. Occurrences of phlogopite and biotite are known to exist in the United States and in fact have been worked in a small way, but no production of these varieties was reported for 1929. A deposit of lepidolite (lithia mica) was operated in New Mexico in 1929, as in former years, and deposits containing vanadium in the form of disseminated roscoelite were worked in Colorado. A small quantity of sericite was produced in California, and vermiculite was commercially mined in Colorado, Montana, and Pennsylvania. When of sufficient importance as a source of ores or chemicals, these and other varieties of mica are discussed in the chapters on Mica in Mineral Resources, but they are not included in the production figures as they contribute in no way to the volume of sheet mica output, which is the primary concern of what is ordinarily thought of as the mica trade.

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[1] Work on manuscript completed February, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The term "uncut sheet" mica is used in the accompanying tables and discussion to designate mica that has been trimmed, some of it roughly trimmed and some well trimmed, but none of it cut to any designated shape. The miner roughly splits up the blocks or crystals, slightly trims the sheets, and classifies and grades them according to size and quality. In parts of New England material of this class is sometimes called "rifted" mica. The manufacturer cuts this uncut mica to size and specification, and drops into the refuse pile as fit only for grinding a large proportion of the material sold to him by the miner. The sheet mica that has been cut to size and shape is termed "cut" mica, and the waste product of the operation is called "shop" scrap. "Shop" scrap usually brings a higher price than "mine" scrap, which is produced when the "run-of-mine" mica is sorted at the mine into sheet and scrap.

Domestic mica sold by producers in the United States, 1920–1929

Year	Sheet mica						Scrap mica		Total	
	Uncut punch mica		Uncut mica larger than punch		Total uncut sheet mica					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
1920	1,153,540	$115,770	529,940	$431,202	1,683,480	$546,972	5,723	$167,017	6,565	$713,989
1921	675,787	67,516	66,058	50,997	741,845	118,513	2,577	56,849	2,948	175,362
1922	911,433	71,127	166,535	123,174	1,077,968	194,301	[1]6,641	114,045	[1]7,180	308,346
1923	1,793,749	134,955	269,430	176,225	2,063,179	311,180	[1]8,054	129,695	[1]9,086	440,875
1924	1,305,219	113,285	155,678	98,750	1,460,897	212,035	4,709	87,242	5,439	299,277
1925	790,183	75,528	1,003,682	246,434	1,793,865	321,962	9,695	173,537	10,592	495,499
1926	1,842,970	228,053	329,189	172,131	2,172,159	400,184	7,043	136,643	8,129	536,827
1927	1,314,742	95,011	197,750	117,471	1,512,492	212,482	6,280	110,139	7,036	322,621
1928	1,468,482	90,931	213,295	140,025	1,681,777	230,956	7,760	132,422	8,601	363,378
1929	1,752,044	98,989	283,084	187,332	2,035,128	286,321	6,253	117,901	7,271	404,222

[1] Includes mica derived from mica schist.

Mica sold by producers in chief producing States, 1925–1929

State and year	Sheet mica						Scrap mica		Total	
	Uncut punch mica		Uncut mica larger than punch		Total uncut sheet mica					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
New Hampshire:										
1925	267,607	$40,096	853,250	$158,762	1,120,857	$198,858	1,953	$47,525	2,513	$246,383
1926	1,220,053	188,850	151,837	47,040	1,371,890	235,890	1,738	38,213	2,424	274,103
1927	674,219	60,744	46,000	18,105	720,219	78,849	1,284	22,909	1,644	101,758
1928	727,775	45,354	46,368	18,116	774,143	63,470	1,291	25,232	1,678	88,702
1929	913,552	48,885	71,226	33,772	984,778	82,657	1,657	35,977	2,149	118,634
North Carolina:										
1925	467,418	30,279	125,060	75,097	592,478	105,376	5,095	74,818	5,391	180,194
1926	541,990	33,847	158,323	116,515	700,313	150,362	2,880	54,048	3,230	204,410
1927	528,978	27,347	136,382	87,167	665,360	114,514	2,995	50,505	3,328	165,019
1928	640,585	33,326	136,810	96,380	777,395	129,706	4,419	69,638	4,808	199,344
1929	737,473	40,081	156,727	110,212	894,200	150,293	3,245	53,855	3,692	204,148

PRICES

In 1929 the range of prices per pound for rough-trimmed uncut sheet mica, as reported to the Bureau of Mines by producers and others engaged in the industry, was as follows:

Range of prices per pound for rough-trimmed uncut sheet mica in 1929

Size	Clear	Stained	Size	Clear	Stained
Punch	$0.04-$0.15	$0.03-$0.06	3 by 4 inches	$1.50-$2.00	$1.20-$1.80
1½ by 2 inches	.20- .35		3 by 5 inches	1.65- 2.15	1.40- 2.00
2 by 2 inches	.35- .50	.20- .45	4 by 6 inches	2.50- 3.00	1.60- 2.50
2 by 3 inches	.60- .95	.40- .85	6 by 8 inches	3.00- 5.00	2.00- 2.75
3 by 3 inches	1.10- 1.60	.70- 1.45	8 by 10 inches	4.00- 7.00	2.25- 3.00

Prices of scrap mica ranged from $10 to $30 a short ton at the mines.

The average value of uncut punch mica sold by producers in 1929 was about 5½ cents a pound; of uncut mica larger than punch, about 66 cents a pound; and of uncut splittings, approximately 8 cents a pound. These average values are derived by dividing the total value of each kind sold by the respective total quantities.

REVIEW BY STATES

Alabama.—Operations in Alabama were conducted on the same very small scale that has characterized the industry in the State for many years. The only output marketed—a few pounds of sheet mica produced and sold to stove manufacturers—reported to the Bureau of Mines came from Randolph County, about 16 miles southwest of Heflin. The property was operated by L. B. Liles through lease from the Seven Sisters Mica & Gold Mining Co., Heflin.

California.—A new development of interest in California was the reported shipment of several hundred tons of sericite for foundry use from the property at Ogilby, Imperial County, operated by C. F. Allebrand. No other production of mica was reported.

Colorado.—Sales of scrap mica were made by E. W. Lehman, who operated the High Line mine near Jamestown, Boulder County. A small tonnage of scrap mica was also reported by the Henry Ramstetter Estate from a property near Golden, Jefferson County. Commercial operations were also conducted by D. E. C. Austin, Turret, who produced and sold a small quantity of vermiculite from the Inspiration mine near Hecla, Chaffee County, and by Joseph W. Kryl (formerly Jefferisite Products Co.), who shipped vermiculite from his property near Westcliffe, Custer County.

Connecticut.—Operations in Connecticut in 1929 were conducted by the Huse-Liberty Mica Co. (a new operator), 73 Long Wharf, Boston, Mass., which produced sheet and scrap mica from its property, known as the West Side mine, at Middletown, Middlesex County. All the sheet mica produced was consumed by the operator, and the scrap was sold to a western concern. This company is a dealer in mica for use in electrical appliances, mica chimneys, tubes, disks, and by stove manufacturers. The Eureka Flint & Spar Co., New York Avenue, Trenton, N. J., operated, as usual, the Strickland mine near Portland, Middlesex County, and sold the product as mine run.

Georgia.—Commercial activities in Georgia were confined to the operations of W. R. Rowland, Yatesville, who produced and sold sheet mica from the Thomas mine at Yatesville, Upson County. However, Miles B. Brown, Thomaston, and John V. Arrendale, Tiger, produced some mica that was not sold. Sales of chlorite schist were reported by Thompson, Weinman & Co. (Inc.), Canton, from its property at Canton.

Idaho.—No sales of mica were reported from Idaho in 1929. R. G. Bennett, of the firm of A. H. Clark & R. G. Bennett, reported that no actual sales were made from the Falls group of claims near Council, Adams County, but that some mica was produced and additional development work would be undertaken. According to a statement by M. P. Gifford, owner, the Mica Queen group of five claims was sold to L. A. Albee, Council, who says that the property is for sale. W. E. Parry, of the Muscovite Mica Co., Lewiston, reported that the company hoped to begin operations as soon as conditions permit.

Maine.—Operations at the Hibbs mine, 1½ miles north of Hebron, yielded several tons of good-quality mica, which was sold in mine-run form to manufacturers for preparation and use in the stove industry and for use as mica chimneys and disks.

Montana.—No sales of mica were reported from Montana for 1929. The Idaho Mica Mining Co., Dubois, Idaho, reported that in the course of assessment work some good clear mica in large sheets was taken from the property near Virginia City, Madison County; the property is for sale or lease. Sales of vermiculite (an altered mica) were reported by the Vermiculite & Asbestos Co., Libby, from its mine near Libby, and by the Zonolite Co., Libby, from the Zonolite mine near Libby. The product of the Zonolite Co. is known as Zonolite after treatment. Vermiculite is steadily finding new fields of usefulness, thereby requiring expansion of mining facilities. The material is subjected to high temperatures, and is milled and screened to various textures. For further information see page 388.

New Hampshire.—In 1929 New Hampshire was the leading source of domestic sheet mica in the United States, producing 48 per cent of the total sold, as compared with 46 per cent of the total in 1928. About 90 per cent of the sheet mica was punch or washer mica. The average values for the different grades were as follows: Punch, 5 cents a pound; larger than punch, 47 cents a pound; splittings, 8 cents a pound; and scrap, about $22 a ton. Operations were conducted by the General Electric Co. at the Alexandria mine, Grafton County; by the Golding-Keene Co. at its property at Alstead, Cheshire County; by the New England Mica Co., Waltham, Mass., at the Ruby mine at Grafton; by the New Hampshire Mica & Mining Co., Keene, at the French mine at Alstead, Cheshire County; and by the Whitehall Corporation, New York City, at the Powell mine near Franklin, Merrimack County. No production was reported from the New England Minerals Co. (Inc.), Boston, Mass. It has been reported that the dumps of the Ruggles mine about 1⅓ miles northwest of Grafton Center, Grafton County, which was formerly operated by the Standard Feldspar Co., Rumney Depot, yielded some sheet and scrap mica, but the Bureau of Mines has been unable to obtain a report of the operations. A small quantity of scrap mica obtained during assessment work at the Star mine at Orange, Grafton County, was sold by James H. Strain, Star Mica Mining Co., 52 Broadway, New York City.

New Mexico.—In 1929 the American Mica Products Co., Chicago, Ill., worked the Miller & Stiles mine and sold the product (sheet mica) to stove manufacturers. Philip S. Hoyt, Las Tablas, reported the sale of several hundred tons of scrap mica obtained from the Las Tablas and Petaca mines in Rio Arriba County. He also reported that he owns and operates the property formerly known as the Fremont Mining & Manufacturing Co. The General Mica Co., Joseph A. Stanko, Pueblo, Colo., reported that the Meda mine in Taos County near Ojo Caliente produced scrap mica which was ground and sold to western consumers. The Apache, Cribbenville, Alamos, Red, White, and Carolinas mines in Rio Arriba County near La Madera were operated by C. L. Johnson, La Madera, who reported a production of several thousand pounds of sheet and scrap mica, which was sold to western consumers. A small tonnage of scrap mica was reported by Paul A. Martinez, Las Tablas, from the Loma mine near Las Tablas, Rio Arriba County. George M. Neel, Santa Fe, reported a few tons of scrap mica obtained from the L. M. No. 3 mine near La Madera, Rio Arriba County, and shipped to a western consumer.

North Carolina.—In 1929 North Carolina was the second largest producer of sheet mica in the United States, ranking next to New Hampshire, and the output represented 44 per cent of the total sold by producers in the United States during the year. Eighty-two per cent of the sales represented punch or small-size mica. In comparison with 1928 the sales of sheet mica increased in both quantity and value, with resultant declines in the quantity and value of scrap mica. In addition to the mica sold in North Carolina muscovite schist was ground by the General Mica Co., Penland, and the Victor Mica Co., Spruce Pine, and sold to manufacturers of roofing materials.

The following list is comprised of producers in North Carolina making sales of sheet mica in 1929.

Producers in North Carolina making sales of sheet mica in 1929

Name and address	Name of mine	Location of mine	
		Nearest town	County
J. E. Burleson Mica Co., Spruce Pine	Big Ridge	Waynesville	Haywood.
Carolina Mineral Co., Spruce Pine	English Knob	Spruce Pine	Mitchell.
	Hoot Owl	Estatoe	Do.
A. E. & Odes Elmore, Casar		Casar	Cleveland.
Franklin Mineral Products Co., Franklin	Burr Knob	Franklin	Macon.
J. C. Pitman, Penland	Chestnut Flat	Penland	Mitchell.
Rickman, Wright, Reuss & Sisk, Franklin	Boyd Knob	Franklin	Macon.
Spruce Pine Mica Co., Spruce Pine	Nos. 10, 21, 22	Spruce Pine	Mitchell.
Tennessee Mineral Products Co., Spruce Pine	Deer Park	do	Do.
	Smith	do	Do.
W. W. Wiseman, Ingalls	Bucklin	do	Do.

All of the companies listed made sales of scrap mica also in 1929 with the exception of A. E. & Odes Elmore, a relatively small producer.

Pennsylvania.—A new producer, the John Warren Watson Co., Philadelphia, reported sales of vermiculite (jefferisite) from the Brinton quarry near West Chester, Chester County.

South Dakota.—The Consolidated Feldspar Corporation, Trenton, N. J., a new operator, reported sales of scrap mica from the Hugo mine near Keystone, which it subleased in February, 1929, from the Keystone Feldspar & Chemical Co., Chicago, Ill. The Peerless mine near Keystone, operated by the Keystone Feldspar & Chemical Co., yielded scrap mica. The product of both companies was sold to a western consumer.

Virginia.—In 1929 H. C. Field, Martinsville, reported sales of sheet and scrap mica from the Martin mine in Pittsylvania County, 5 miles from Axton. The entire product was sold to consumers in Virginia. The property of the General Minerals Corporation, Chula, consisting of several mines in Amelia County near Chula, yielded sheet and scrap mica. The Mica Products Corporation, Norfolk, a new operator, reported sales of clear sheet and scrap mica from its property in Henry County near Axton.

USES

Sheet mica.—Mica finds its most important application in the manufacture of electrical equipment and appliances, where a noninflammable, resistant insulating material is necessary. Its cleavage, transparency, toughness, softness, flexibility, and elasticity, combined with its resistance to electric puncture, infusibility, and imperviousness to moisture, render it an ideal insulator. All sizes of sheet mica are in demand, from the smallest (punch) to 6 by 8 inches and larger. The principal uses of mica in electrical apparatus are in the ignition systems of engines of airplanes, automobiles, and trucks, for radio apparatus, in the manufacture of the telephone transmitter button, as an insulator between the copper segments of commutators in direct-current dynamos and motors, for several kinds of transformers, and for washers and rings around bolts and screens requiring insulation. Large disks and washers are used in arc lights and smaller ones in the sockets for incandescent lamps. The former demand for sheet mica for making spark-plug cores has been supplanted to a large extent by the development of improved spark-plug porcelains.

High-potential condenser mica must be clear or only slightly stained, must split easily and smoothly into films as thin as one-sixteenth of an inch, and must be free from cracks, holes, foreign substances, stains, spots, and air bubbles; the sheets must be plane, smooth, and free from waves, wrinkles, rulings, or knots.

Mica used between the copper segments of commutators must possess high dielectric strength; that is, it must be able to withstand charges of high-voltage electrical current and be soft enough to wear down evenly with the copper segments. Phlogopite or "amber" mica is particularly suitable for this purpose.

The quality of resonance possessed by mica makes it of special value for use in such sound-producing and sound-detecting devices as phonographs, submarine detectors, radiophones, and loud speakers.

Phonograph and other diaphragm mica must be of very high grade. It must be clear and transparent, free from all cracks, inclusions, stains, air bubbles, or rulings, and must split easily into perfectly flat sheets; the last-named feature is essential.

Mica also finds application in the stove industry for glazing in the fronts of stoves, in furnace sightholes, for screens in front of highly heated material, for optical lanterns as a retarder of heat waves, and for making lamp chimneys, lamp shades, and lantern slides.

Stove mica is essentially clear, hard, and rigid; much of the North Carolina mica, especially the greenish, is well adapted for this use. The demand for mica for glazing is comparatively small, and only the best quality and the larger sheets are thus used.

Mica for lamp chimneys and canopies must be clear and must split easily and be very flexible. Very little domestic mica is used for this purpose. Indian and Brazilian mica are used instead.

Mica splittings for built-up mica board, which is used in electric insulation, consist of thin flakes or films split from the smaller sheets of mica. Splittings are about one-thousandth of an inch in thickness, are irregular in shape, and contain a very small number of flaws. The built-up product is prepared by first coating a surface with shellac or other binder and laying the flakes thereon irregularly in a single layer. A second coat of binder and layer of flakes is then laid over them in such a manner as to cover the spaces between the flakes of the first layer. This process is continued until any required thickness is reached, when the whole is subjected to pressure and baking. In this way large composite sheets are made of uniform thickness, which are free from foreign substances and such imperfections as tend to lessen the value of mica for some insulating purposes. The finished product may be bent, cut, sawed, or drilled. Mica board is used chiefly for plates between the copper segments of commutators and in dynamos, motors, and transformers.

Consumption of mica splittings.—The consumption of mica splittings in the United States in 1929, as reported by consumers, was as follows: Indian splittings, 2,969,224 pounds, valued at $2,012,974; Canadian splittings, 506,712 pounds, valued at $237,832; Madagascan splittings, 285,403 pounds, valued at $197,438; and domestic splittings, 20,948 pounds, valued at $1,645. Some South American splittings were used by consumers, but the Bureau of Mines is not at liberty to publish the figures.

Scrap and ground mica.—Mica unsuitable for use as sheet mica is classed as scrap mica. It is ground to a powder and used as a decorative material in the manufacture of wall paper, fancy paint, ornamental tile, and concrete facing; in the roofing-materials industry as a component in some patent roofing material and as a dusting agent for rolled roofing; and in the rubber industry as a lubricant both dry, as for auto tires, and mixed with oil and grease for lubricating metal bearings and other articles where an excess of grease or oil is undesirable. It is also used in the manufacture of axle grease. The high heat resistance and dielectric strength of mica render it suitable also for the manufacture of certain forms of electric insulation; molded mica (ground mica with shellac or other binder) is used for this purpose. As an insulator it is employed also in the manufacture of fireproof paints and coverings. Ground mica is also used for annealing steel; in the manufacture of Christmas-tree snow, large quantities of which are consumed by the moving-picture industry; and in various other ways.

More than 85 per cent of the total commercial production of mica in the United States in 1929 was scrap mica, consisting of mine scrap, shop scrap, and scrap obtained from the working of old dumps. The scrap is not used in its raw state, but is ground to powder by dry and wet processes. Statistics show that the largest proportion of ground mica in 1929 was consumed by the wall-paper trade, with the rubber trade second in importance, and the roofing-materials industry third. If the mica schist consumed were included with the ground mica, the figures probably would show that the roofing-materials industry led all others as a consumer of mica and mica schist. Ground mica and mica schist have supplanted to some extent the use of talc in the manufacture of prepared roofing.

Consumption of ground mica.—The following figures distribute the 1929 sales of ground mica by methods of grinding and by consuming industries in the United States, in so far as they have been reported by producers. The figures do not represent the total production of ground mica in the United States, for in addition to the part of the production which is shipped to foreign consumers there is also unaccounted for part of the scrap-mica output which has not been traced to points of consumption where it may be ground by the consumers. Moreover, the figures do not cover biotite or muscovite schist, sericite schist, chlorite schist, and vermiculite (an altered mica), materials allied to mica and used for some of the same purposes as ground mica. Figures for these materials are given under the caption Minerals and Materials Allied to Mica, on page 388.

Ground mica sold in the United States, 1925–1929, by methods of grinding

Year	Dry ground		Wet ground		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
1925	5,043,020	$101,680	4,803,930	$279,940	9,846,950	$381,620
1926	4,750,790	98,290	4,980,400	206,370	9,731,190	304,660
1927	5,187,063	90,968	6,398,320	332,511	11,585,383	423,479
1928	5,743,052	95,151	6,633,965	358,458	12,377,017	453,609
1929	3,637,192	62,029	5,395,005	328,332	9,032,197	390,361

Ground mica sold to various industries in the United States in 1929

Industry	Quantity		Value
	Pounds	Per cent of total	
Wall paper	3,227,520	36	$202,386
Rubber	2,632,305	29	119,103
Roofing	1,206,746	13	18,132
Miscellaneous[1]	1,965,626	22	50,740
	9,032,197	100	390,361

[1] Figures cover mica used for molded electric insulation, surfacing on asphalt shingles, filler for fancy paints, ornamental tile, Christmas-tree snow, manufacture of axle greases and oil, annealing, concrete and foundry facing, calico printing, and plastic specialties.

IMPORTS AND EXPORTS

Mica imported for consumption in 1929 included unmanufactured, ground, cut (dimension sheets), splittings, built-up mica boards, cups, tubes, and mica plates, washers, and "other manufactures." The imports of uncut sheet mica in 1929, exclusive of the Madras square uncut sheets, were 1,283,472 pounds, valued at $729,158, an increase of 137 per cent in quantity and 148 per cent in value compared with 1928. Imports of ground mica in 1929 were 1,020 pounds, valued at $43. In comparison with the preceding year imports of cut mica (dimension sheets) in 1929 increased 139 per cent in quantity and 115 per cent in value. Imports of mica splittings, which constituted 78 per cent of the total quantity of mica imported in 1929, increased 45 per cent in quantity and 25 per cent in value. Imports of built-up mica boards, etc., increased 174 per cent in quantity and 116 per cent in value. Imports of washers decreased 65 per cent in quantity and 48 per cent in value.

Mica imported for consumption in the United States, 1924–1929, by kinds

Kind	1924		1925		1926	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured[1]	671,793	$419,154	604,550	$526,292	818,381	$562,300
Ground	1,342,107	22,034	950,614	13,120	140,732	2,048
Cut mica (dimension sheets)	74,534	69,018	41,284	63,466	46,662	44,621
Splittings	3,619,229	1,681,774	3,239,554	1,113,202	5,229,858	1,750,434
Built-up mica boards, cups, tubes, and mica plates	18,205	41,455	14,639	16,785	15,147	15.410
Washers	18,517	5,325	222	50	4,620	1,723
Other manufactures	56,766	88,146	50,445	65,912	62,696	74,298
	5,801,151	2,326,906	4,901,308	1,798,827	6,318,096	2,450,834

Kind	1927		1928		1929	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured[1]	776,307	$399,302	541,635	$294,194	1,283,472	$729,158
Ground			150	53	1,020	43
Cut mica (dimension sheets)	64,075	75,469	49,555	93,964	118,224	201,632
Splittings	2,588,253	1,123,808	3,496,353	1,025,790	5,052,848	1,277,555
Built-up mica boards, cups, tubes, and mica plates	8,097	9,211	4,986	4,539	13,655	9,805
Washers	1,732	536	3,296	1,291	1,170	674
Other manufactures	21,183	21,983	9,000	6,664	5,276	4,541
	3,459,647	1,630,309	4,104,975	1,426,495	6,475,665	2,223,408

[1] Essentially uncut trimmed sheets.

The accompanying table shows the countries from which the mica imported into the United States in 1929 was last shipped. Imports from India formed 73 per cent of the total in 1929, compared with 69 per cent in 1928. Mica from India is muscovite and that from Canada is almost entirely phlogopite. Seventy-nine per cent of the mica imported into the United States in 1929 came from these two countries. Imports from India gained 100 per cent in quantity and 86 per cent in value over 1928 and those from Canada 143 per cent in quantity and 73 per cent in value. Imports of mica (phlogopite) from Madagascar, chiefly splittings, decreased more than 50 per cent in quantity compared with those in 1928.

Mica imported into the United States in 1929, by kinds and by countries

[General imports]

Country	Crude or unmanufactured				Cut mica, dimension sheets (duty 30 per cent)		Mica splittings (duty 30 per cent)		Ground mica	
	Valued at not above 15 cents per pound (duty 4 cents per pound)		Valued at above 15 cents per pound (duty 25 per cent)							
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:										
Madagascar	-------	-------	8,398	$1,961	-------	-------	54,021	$10,509	-------	-------
Union of South Africa	-------	-------	163	433	-------	-------	-------	-------	-------	-------
Argentina	2,725	$384	46,443	26,614	-------	-------	-------	-------	-------	-------
Australia	575	76	1,740	1,336	-------	-------	-------	-------	-------	-------
Austria	-------	-------	-------	-------	100	$369	-------	-------	-------	-------
Brazil	3,404	296	29,277	11,541	530	336	228	46	-------	-------
Canada	279,369	33,155	2,772	2,157	162	377	178,879	94,475	1,020	$43
Chile	-------	-------	-------	-------	-------	-------	2,282	522	-------	-------
China	-------	-------	90	162	-------	-------	-------	-------	-------	-------
France	5,754	675	74,203	43,605	38,553	115,622	442,387	114,975	-------	-------
Germany	-------	-------	6,073	3,184	12,525	17,959	39,971	6,855	-------	-------
Guatemala	-------	-------	15,389	10,054	1,550	1,459	372	122	-------	-------
India, British	2,716	515	559,476	398,467	32,445	35,732	4,507,990	893,920	-------	-------
Italy	-------	-------	-------	-------	1,019	485	2,240	318	-------	-------
United Kingdom	7,253	1,000	271,586	216,576	30,887	29,465	327,825	90,603	-------	-------
	301,796	36,101	1,015,610	716,090	117,771	201,804	5,556,195	1,212,345	1,020	43

Country	Built-up mica products, boards, cups, tubes, and mica plates (duty 40 per cent)		Washers (duty 30 per cent)		Other manufactures, not specially provided for (duty 40 per cent)		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:								
Madagascar	-------	-------	-------	-------	-------	-------	62,419	$12,470
Union of South Africa	-------	-------	-------	-------	-------	-------	163	433
Argentina	-------	-------	-------	-------	-------	-------	49,168	26,998
Australia	-------	-------	-------	-------	-------	-------	2,315	1,412
Austria	-------	-------	-------	-------	39	$85	139	454
Brazil	-------	-------	-------	-------	422	187	33,861	12,406
Canada	37	$89	-------	-------	-------	-------	462,239	130,296
Chile	-------	-------	-------	-------	-------	-------	2,282	522
China	-------	-------	-------	-------	-------	-------	90	162
France	-------	-------	-------	-------	10	12	560,907	274,889
Germany	11,003	7,300	1,215	$935	653	889	71,440	37,122
Guatemala	-------	-------	-------	-------	-------	-------	17,311	11,635
India, British	776	1,996	20	7	2,400	2,695	5,105,823	1,333,332
Italy	-------	-------	-------	-------	140	38	3,399	841
United Kingdom	-------	-------	-------	-------	30	163	637,581	337,807
	11,816	9,385	1,235	942	3,694	4,069	7,009,137	2,180,779

Mica and manufactures of mica exported in 1929 amounted to 6,187,270 pounds, valued at $329,322, compared with 3,661,587 pounds, valued at $229,391, in 1928. As the classes of mica are not shown in export schedules, it is impossible to state what kinds of mica are exported.

WORLD PRODUCTION

World production of mica, 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country [1]	1925	1926	1927	1928	1929
North America:					
Canada (sales)	3,647	2,309	2,484	3,320	3,677
Guatemala	16	12	7	[2] 13	[2] 1
United States (sales)	9,609	7,374	6,383	7,803	6,596
South America:					
Argentina [3]	152	99	106	120	119
Bolivia	(4)	25	17	(5)	(5)
Brazil [2]	65	52	39	44	45
Europe:					
Norway [2]	23	42	8	85	59
Russia [6]	18	65	15	266	(5)
Sweden	95	53	10	12	66
Asia:					
Ceylon [2]	1	--------	--------	--------	--------
Chosen	20	16	35	29	26
India, British [7]	5,065	4,569	3,937	4,850	5,897
Japan	1,082	(5)	(5)	(5)	(5)
Russia [6]	175	421	1,505	1,227	(5)
Africa:					
Ethiopia	--------	--------	2	--------	--------
Madagascar [8]	288	330	505	861	380
Rhodesia—					
Northern	1	4	8	4	3
Southern	132	166	186	186	172
Tanganyika Territory	69	53	43	34	29
Union of South Africa (Transvaal) (sales)	1,462	872	1,454	3,419	1,464
Oceania:					
Australia—					
Central Australia [9]	3	3	2	23	24
North Australia [9]			--------	--------	--------
Queensland	1	--------	1	--------	--------
South Australia	--------	--------	--------	2	--------
Western Australia [2]	--------	4	4	--------	--------

[1] In addition to the countries listed France reports a production of 1 ton in 1926 and New South Wales a production of 3 tons in 1929.

[2] Exports.

[3] Rail and river shipments.

[4] Less than 1 ton.

[5] Data not available.

[6] Year ended Sept. 30.

[7] Exports. The figures for output are incomplete, and a more accurate idea of the size of the industry is to be obtained from the export figures. (Rec. Geol. Surv. of India, vol. 59, pt. 3, p. 273. Calcutta, 1926.) Output is reported as follows: 1925, 2,336 tons; 1926, 2,130 tons; 1927, 2,165 tons; 1928, 2,292 tons; 1929, 2,704 tons.

[8] Exports reported as follows: 1925, 267 tons; 1926, 296 tons; 1927, 544 tons; 1928, 635 tons; 1929, 427 tons.

[9] Northern Territory prior to division in 1927 into Central Australia and North Australia.

COMMERCIAL VARIETIES OF MICA

INTRODUCTION

The name "mica," of more or less indistinct Latin origin, is applied to a group of widely distributed minerals having similar physical properties and related chemical structure. The mineral is also called "isinglass," but the latter term is correctly applied only to a gelatinous material obtained from certain fish.

All micas are characterized by a perfect cleavage, which permits them to be split into very thin transparent or semitransparent sheets. These sheets are flexible, elastic, and generally soft, yet they are strong and possess pronounced resistance to decomposition and to the conduction of heat and electricity. This combination of properties is not found in any other commercial mineral.

MUSCOVITE

The name muscovite is derived from the Latin *vitrum muscovitum*, muscovy glass. Muscovy is the ancient name for the central part of Russia where muscovy glass or mica was formerly used for windowpanes.

Like all the other varieties of mica, muscovite crystallizes in the monoclinic system, approximating hexagonal symmetry. It is generally light-colored but ranges from colorless in thin sheets to amber, yellow, green, or brownish red in sheets more than one-sixteenth of an inch in thickness.

Occurrence.—Deposits of sheet muscovite (white mica) occur only in pegmatite, an igneous rock similar in composition to granite but much coarser grained. Mica-bearing pegmatites are generally associated with highly metamorphosed rocks of considerable geological age, such as various schists and gneisses, although a few deposits occur in granite that has not been metamorphosed. Most of the schists and gneisses containing mica-bearing pegmatites are of pre-Cambrian age. The chief minerals of pegmatite are quartz, feldspar, and mica, but the rock also contains smaller quantities of other minerals, such as tourmaline, garnet, and beryl. Commercial muscovite is usually found in rough blocks without crystal outline; it may also be found in distinct crystals which are often called "blocks" or "books." The terms "book mica" or "block mica" applied to domestic mica are synonymous with "mine-run" or "run-of-mine" mica. Muscovite also occurs frequently as small flakes or scales in granite, gneiss, schist, sandstone, and shale. Mica schist is crushed, ground, and used largely in the roofing industry.

Distribution.—Muscovite is the most widely distributed and commercially valuable of all the micas. With the exceptions noted on page 373 it is practically the only kind mined in the United States.

In 1929 deposits of muscovite were worked commercially in the United States in Alabama, Colorado, Connecticut, Georgia, Maine, New Hampshire, New Mexico, North Carolina, South Dakota, and Virginia. In addition to these States mica is known to occur in Arizona, California, Idaho, Maryland, Massachusetts, Montana, Nevada, New Jersey, New York, Pennsylvania, South Carolina, Texas, Utah, Vermont, Washington, and Wyoming.

Foreign countries producing mica (muscovite and phlogopite) for sale in 1929, in order of output, were India (British), Canada, Union of South Africa (Transvaal), Russia (ranked according to 1928 production), Madagascar, Rhodesia, Argentina, Sweden, Norway, Brazil, Tanganyika Territory, Chosen, Australia, and Guatemala.

Prospecting.—According to H. N. Kirk,[3] a miner of mica in New Hampshire, the edges of the pegmatite dikes may be covered with moss, fern, and brush, and even trees. If rock of seeming potentialities underlies the moss a bog hoe may be used to clear a trench about 3 feet wide at right angles to the general course of the dike. As the moss and the rich, black, leaf mold are removed it should be noticed whether or not the dirt contains any amount of mica. If small pieces of mica are plentiful and the overburden not too great it would be advisable to continue this course until the walls of a pegmatite dike are found. In some parts of New Hampshire such walls are called "slate"; however, this slate is not like that used for blackboards in schools, for roofing slate, etc., but may be a coarse or fine grained rock of dark color, composed mainly of quartz, hornblende, and tourmaline. It splits easily in one direction into flat slabs and drills very easily. Near the edge where the slate forms a union with the pegmatite dike a vein of mica can usually be found. It is important for the ledge to be brushed off clean, as "books" of mica frequently will be found standing on edge and will present a very compact, highly polished, dark appearance. To one not familiar with mica deposits these "books" look like dark crystals other than mica embedded in the white rock, but a few blows of the bog hoe will reveal their identity, as the flakes of mica fly when the "books" are struck.

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[3] Kirk, H. N., Prospecting for Mica in New Hampshire: Rock Products, vol. 33, No. 13, June 21, 1930, pp. 68–69.

Development.—Before exploitation of a deposit is undertaken, the following factors should be ascertained: (1) The supply of first-quality mica that reasonably could be expected to be recovered, (2) the situation of the deposit in relation to transportation, and (3) the amount of waste rock and overburden that must be removed. The successful development of many mica deposits depends upon their output of clear sheet that can be cut into sheets 1½ by 2 inches and larger, as the scrap mica suitable only for grinding is but an incidental by-product. The average yield of mica from a deposit consists of about 10 per cent sheet and 90 per cent scrap. Producers or shippers of domestic mica should be familiar with and observe the requirements as to proper methods of grading and preparing mica by specification. The specifications required by the manufacturer are often rigid as to quality, size, and uniformity, and some of the domestic miners have not met the requirements as successfully as foreign producers.

Mining.—Mica mining in the United States is not conducted regularly or systematically by every producer. Many of the mines are worked by small operators who mine only intermittently and use very primitive methods. Operations are frequently of the type known as "gophering" or "groundhogging," which consists of following the blocks of mica as long as the removal of one discloses the presence of another to obtain all the mica available without reference to any planned development. The method is popular in some parts of the South and is considered efficient where the run of mica in a deposit is not constant. In an operation of this type the waste rock is left to accumulate because of the difficulty of removing it through the small tunnels and openings. These accumulations soon hinder further development. Improved methods of mining by systematic shafts, tunnels, drifts, stopes, and crosscuts have in some places supplanted the gophering method; some mines have been equipped with hoists, power drills, pumps, and electric lights, although many have not been supplied with such modern equipment.

Regular quarry methods may be used in exploiting some large masses of pegmatite. This system is common in the New England mica mines, where mica is obtained from open pits and derricks and inclined tracks are used to remove ore and waste.

Forms in which marketed.—Mica is marketed as mine-run, as sheet, and as scrap for grinding. The terms "mine-run mica," "run-of-mine mica," "book mica," and "block mica" are used synonymously for domestic mica just as it comes from the mine, but with the adhering rock removed. Commercial sheet mica may be split into extremely thin sheets, about one-sixteenth of an inch in thickness. The sheets are classified by size and graded as to quality.[4] Scrap mica is mica that does not possess the qualifications for use as sheet mica. It is ground to a powder and used in various ways in the ground-mica industry.

Commercial sheet mica, by far the most valuable form, is classified by sizes, depending upon the dimensions of the usable circle or rectangle that can be cut from a rough-trimmed piece. Punch, the smallest size salable in the form of uncut sheet, measures 1½ inches in diameter if stained and 1¼ inches if clear. The next larger size is "circle" mica, which should provide a usable disk nearly 2 inches in diameter. The smallest rectangular piece salable in the form of uncut sheet is 1½ by 2 inches, and the sizes following are 2 by 2 inches, 2 by 3, 3 by 3, 3 by 4, 3 by 5, 4 by 6, 6 by 8, 8 by 10, and larger. Splittings are the very thin sheets or films of mica split from the smaller uncut sheet mica.

PHLOGOPITE

Phlogopite is a variety of mica that is somewhat allied to biotite in composition. The mineral ranges in color from quite colorless and transparent to yellowish brown, silvery gray, yellow, brown, green, copper, or bronze red, hence the trade names of "amber," "silver," and "bronze" mica. It occurs in crystalline limestones, dolomites, schists, and serpentine. The chief producing localities are the Provinces of Ontario and Quebec, Canada, whose commercial output in 1929 was 4,053 short tons. Phlogopite mica is used for practically the same purposes as muscovite. Some manufacturers of electric machinery prefer phlogopite for commutators, because it has more nearly the hardness of copper and thus does not have the tendency of muscovite to wear down the copper segments.

BIOTITE

Biotite mica is named for the French physicist J. B. Biot, who in 1816 found the magnesia micas, biotite and phlogopite, to be optically uniaxial or nearly so. Biotite differs from phlogopite in that it contains a considerable but widely varying amount of iron. The mineral is usually dark brown or black but may be light brown or greenish. Biotite (black or iron mica) is probably the most common variety of all the micas but has little economic value, chiefly because the sheets are almost invariably small and brittle and lack transparency. Small quantities, however, have been produced in the United States, chiefly in North Carolina. This product is ground and used in the roofing-materials industry.

LEPIDOLITE

Lepidolite occurs in pegmatite, usually in the form of compact, fine scales, and has chief value as a component of certain glasses and as a source of lithium. In 1929 New Mexico was the only source of commercial production in the United States. A small quantity for use in the glass industry has been shipped into the United States regularly from the Province of Manitoba, Canada, where it is found as masses of small flakes in pegmatite.

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[4] Myers, W. M., Mica: Inf. Circ. 6205, Bureau of Mines, December, 1929, p. 25.

ROSCOELITE

Roscoelite, another fine-grained mica, is an important source of vanadium. This mica occurs in the form of minute scales, usually dark brown to green in color. In the United States it is produced commercially near Rifle in Garfield County, Colo. Because roscoelite is mined for its metallic content, it is discussed in Mineral Resources in the section on vanadium in the chapter on Rare Metals; the output is included in the statistics on vanadium ore.

ZINNWALDITE

The lithium-iron mica zinnwaldite is mined at Zinnwald, Germany, for its lithium content. It occurs as grayish-colored scales in the tin-bearing granites of Cornwall, England, and in several other localities.

FUCHSITE

Fuchsite is named for the chemist J. N.v. Fuchs. It is a chromium-bearing mica and occurs in Schwarzen-Stein in the Ziller Thal (Austria), in Ouro Preto in the State of Minas Geraes (Brazil), in the Urals (Russia), and in the Province of Manitoba (Canada). In the United States it occurs in Montgomery County, Md.

Fuchsite schist has been produced commercially in southeastern Manitoba, Canada. The product was shipped to Winnipeg, where it was crushed and utilized for stucco purposes.

SERICITE

Sericite is the fine, scaly variety of muscovite mica, such as is commonly found in certain varieties of schist or as an alteration product of feldspars. In its natural occurrence it is usually intermixed with other minerals, of which quartz is so abundant that it is almost impossible to obtain the sericite in a pure form. On account of its characteristic silky appearance it was named from the Greek word signifying this quality.

Sericite schists are abundant in the Southeastern States from Virginia to Georgia. A deposit of unusual purity occurs near Jasper, Ga., and the material is also known to exist in other places. Ground sericite schist has been used in the manufacture of axle greases, roofing composition, foundry facing, and rubber goods. In 1929 the only commercial production of sericite schist in the United States, reported to the Bureau of Mines, came from California.

Sericite has also been of interest as a possible source of potash and alumina, but these possibilities have never been developed commercially.

In northern Georgia near Jasper[5] and Cartersville[6] there are sericite schists and slates which are reported to carry from 4.2 to more than 10 per cent K_2O. The potash, however, is locked up with the silica and alumina present in the material.

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[5] Hopkins, Oliver B., A Report on the Asbestos, Talc, and Soapstone Deposits of Georgia: Geol. Survey of Georgia Bull. 29, 1914, p. 355.

[6] Shearer, H. K., Report on Slate Deposits of Georgia: Geol. Survey of Georgia Bull. 34, 1918, pp. 132 and following.

MINERALS AND MATERIALS ALLIED TO MICA

The minerals and materials allied to mica by similar constitution, physical characteristics, and uses include the following: (1) Vermiculite, (2) sericite schist, (3) clinochlore (chlorite schist), (4) muscovite-mica schist, and (5) biotite-mica schist. With the exception of biotite schist commercial production of all these materials in 1929 was reported to the Bureau of Mines. The total quantity sold by producers in 1929 was 9,577 short tons, valued at $96,028. The figures cover both crude and ground material; they are not included in the figures given in this report for mica production in the United States.

The uses of vermiculite have increased steadily within the last few years. E. N. Alley, president of the Zonolite Co., Libby, Mont., who operates a vermiculite property (see p. 376), states that the product after being heated is used as an insulating material against excessive high and low temperatures; as a decorative material for plastered walls; as a component of wall paper, wall board, paint, and various cement products; as a covering for pipes and boilers; as a fireproof and insulating packing in hollow wall spaces, safes, filing cabinets, incubators, bank vaults, and fireless cookers; and as a raw material in the manufacture of fireproof roofing material. Combined with fibrous material and manufactured into molded form it is said to possess high thermal insulation properties for use in secondary or insulating refractories.

CEMENT [1]

By B. W. Bagley

GENERAL REVIEW

The final figures of production and shipments of Portland cement in 1929 confirmed the estimates published by the Bureau of Mines early in January, 1930. These estimates, summarized from the monthly reports of producers and indicating a production of about 170,198,000 barrels and shipments of about 169,394,000 barrels, were within 0.3 per cent each of the final figures for the year. The production of Portland cement in 1929—170,646,036 barrels—showed a decrease of 3 per cent, as compared with 1928, the first decrease recorded in the yearly output since 1921.

In 1929 there were shipped from the mills 169,868,322 barrels of Portland cement, valued at $252,153,789, decreases from the preceding year of 3 per cent in quantity and of nearly 9 per cent in gross value. The average factory value per barrel, in bulk, was $1.48, a decrease of 9 cents per barrel as compared with 1928.

The stocks of finished Portland cement at the mills reached a total of 23,537,817 barrels on December 31, 1929, a gain of 3 per cent over the reserves on December 31, 1928, and the largest on hand at the end of any year during which official records of this item have been kept. At the end of December, 1929, according to estimates by the manufacturers, there were also on hand at the mills 7,526,000 barrels of clinker or unground cement, as compared with 7,422,000 barrels at the end of 1928.

Monthly production in 1929 was at a considerably lower rate than in 1928 except in January and April, when slight increases were recorded. Shipments also showed decreases from 1928 in each month except April, June, July, and August. Shipments and production of Portland cement both reached their maximum for the year in August. The shipments in August—23,052,000 barrels—were greater than for any other month in the history of the industry. Beginning with September the monthly shipments were lower than in the corresponding months of 1928. Shipments in December, 1929, were less than for the corresponding month in any year since 1924.

At the end of October, when reserves of both finished cement and clinker or unground cement were lowest, about 15,381,000 barrels of finished cement and 5,934,000 barrels of clinker were in stock at the mills. The monthly average for the finished cement stocks for the year was more than 24,392,000 barrels and for the clinker stocks 10,685,000 barrels, as compared with 22,701,000 barrels and 10,550,000 barrels, respectively, for 1928.

Production and shipments of masonry, natural, and puzzolan cements also decreased in 1929, production decreasing 0.04 per cent and shipments nearly 2.5 per cent in comparison with 1928.

The general trend of building construction during the years 1926 to 1929 is shown by the following table, which summarizes the value of buildings as shown by permits issued during those years in 210 cities representing all parts of the United States. The grand totals for the four years show successive decreases. All districts except three shared in the total decrease of 11 per cent in 1929 from 1928.

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[1] Work on manuscript completed January, 1931.

Value of buildings shown by permits issued in 210 cities in the United States, 1926-1929 [1]

Group of cities in—	1926	1927	1928	1929	Increase or decrease, 1929 from 1928 (per cent)
New England	$198,844,000	$189,912,000	$177,570,000	$168,753,000	−5
New York and northern New Jersey	1,317,532,000	1,168,291,000	1,162,451,000	1,123,146,000	−3
Eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia	316,990,000	259,855,000	275,701,000	252,136,000	−9
Western Pennsylvania, West Virginia, Ohio, and Kentucky	273,862,000	253,651,000	254,880,000	207,741,000	−18
Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Nebraska, and Oklahoma	894,393,000	828,351,000	758,958,000	593,611,000	−22
Minnesota, North Dakota, and South Dakota	48,762,000	40,726,000	37,259,000	37,943,000	+2
North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana	228,085,000	156,252,000	156,891,000	103,417,000	−34
Arizona, New Mexico, and Texas	94,769,000	85,300,000	84,826,000	86,956,000	+3
Colorado, Utah, Montana, Idaho, and Wyoming	25,682,000	28,629,000	28,983,000	31,342,000	+8
California, Washington, and Oregon	359,802,000	329,104,000	286,748,000	252,330,000	−12
	3,758,721,000	3,340,071,000	3,224,267,000	2,857,375,000	−11

[1] From Bulletin of Portland Cement Association, showing values tabulated in detail by cities, based on Bradstreet's and F. W. Dodge Corporation building statistics.

The following table summarizes the value of contracts awarded in Eastern and Central States for buildings of all classes and for engineering construction of all other kinds, including public works.

Value of contracts awarded for building and all other construction work in Eastern and Central States, 1926–1929 [1]

Group of States	1926	1927	1928	1929	Increase or decrease, 1929 from 1928 (per cent)
New England	$441,183,000	$412,767,000	$495,581,000	$398,382,000	−20
New York and northern New Jersey	1,775,060,000	1,684,445,000	1,814,317,000	1,467,273,000	−19
Eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia	689,414,000	721,148,000	787,673,000	671,500,000	−15
Western Pennsylvania, West Virginia, Ohio, and Kentucky	741,368,000	758,135,000	723,416,000	685,536,000	−5
Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Nebraska, and Oklahoma	1,669,043,000	1,812,849,000	1,934,775,000	1,681,836,000	−13
Minnesota, North and South Dakota, and northern Michigan	102,118,000	83,817,000	80,191,000	94,505,000	+18
North and South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana	730,317,000	610,789,000	560,925,000	537,459,000	−4
Texas	232,412,000	219,105,000	231,409,000	217,800,000	−6
	6,380,915,000	6,303,055,000	6,628,287,000	5,754,291,000	−13

[1] From Bulletin of Portland Cement Association, based on compilations by F. W. Dodge Corporation.

CHIEF HYDRAULIC CEMENTS

The accompanying table gives statistics of output of Portland and other (masonry, natural, and puzzolan) hydraulic cements from 1920 to 1929. The quantity of these cements produced in the United States in 1929 decreased 3 per cent as compared with 1928; the shipments from the mills in 1929 decreased 3 per cent also in quantity and nearly 9 per cent in value.

Statistics of output of alumina cement, representing the operations of only one manufacturer in the United States, are not included in this or other tables of this report. No production of this type of cement was reported for 1923, but it was marketed from 1924 to 1929. The indications are that its use will steadily increase.

Principal hydraulic cements produced and shipped in the United States, 1920–1929

Year	Number of active plants	Production				
		Portland cement, barrels	Masonry, natural, and puzzolan cements		Total	
			Number of active plants	Barrels	Number of active plants	Barrels
1920	117	100, 023, 245	9	(1)	126	(1)
1921	115	98, 842, 049	9	(1)	124	(1)
1922	118	114, 789, 984	9	(1)	127	(1)
1923	126	137, 460, 238	10	(1)	136	(1)
1924	132	149, 358, 109	10	(1)	142	(1)
1925	138	161, 658, 901	10	1, 729, 343	148	163, 388, 244
1926	140	164, 530, 170	11	2, 104, 891	151	166, 635, 061
1927	153	173, 206, 513	11	2, 123, 868	164	175, 330, 381
1928	156	176, 298, 846	11	2, 210, 404	167	178, 509, 250
1929	163	170, 646, 036	11	2, 209, 465	174	172, 855, 501

Year	Shipments					
	Portland cement		Masonry, natural, and puzzolan cements		Total	
	Barrels	Value	Barrels	Value	Barrels	Value
1920	96, 311, 719	$194, 439, 025	767, 481	$1, 150, 890	97, 079, 200	$195, 589, 915
1921	95, 507, 147	180, 778, 415	539, 402	897, 025	96, 046, 549	181, 675, 440
1922	117, 701, 216	207, 170, 430	889, 428	1, 293, 598	118, 590, 644	208, 464, 028
1923	135, 912, 118	257, 684, 424	1, 271, 674	1, 947, 352	137, 183, 792	259, 631, 776
1924	146, 047, 549	264, 046, 708	1, 418, 461	2, 006, 559	147, 466, 010	266, 053, 267
1925	157, 295, 212	278, 524, 108	1, 751, 725	2, 551, 583	159, 046, 937	281, 075, 691
1926	162, 187, 090	277, 965, 473	2, 031, 851	2, 820, 110	164, 218, 941	280, 785, 583
1927	171, 864, 728	278, 854, 647	2, 158, 323	2, 881, 029	174, 023, 051	281, 735, 676
1928	175, 838, 332	275, 972, 945	2, 213, 645	2, 910, 097	178, 051, 977	278, 883, 042
1929	169, 868, 322	252, 153, 789	2, 159, 130	2, 950, 717	172, 027, 452	255, 104, 506

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[1] Figures for production of masonry, natural, and puzzolan cements not available.

PORTLAND CEMENT

PRODUCTION, SHIPMENTS, AND STOCKS

Including Arkansas, Idaho, and Wyoming, in each of which one new plant began manufacturing Portland cement in 1929, there were 35 producing States in 1929 as compared with 32 in 1928. Of the 32 States in which Portland cement was manufactured in both 1928 and 1929, 15 showed increases in production and 13 showed increases in shipments in 1929 as compared with 1928. All the commercial districts, except western Missouri-Nebraska-Kansas-Oklahoma-Arkansas and Texas, showed decreased production, and all except these two districts and Colorado-Montana-Utah-Wyoming-Idaho and New York-Maine showed decreased shipments; the decreases in production ranged from 0.7 to 14 per cent and in shipments from 2 to 15 per cent. The net change for the country as a whole was a decrease of 3 per cent in both production and shipments. The production of 170,646,036 barrels of 376 pounds net is equivalent to 682,584,144 sacks, 28,644,156 long tons, or 32,081,455 short tons. In 1929 production exceeded shipments by 777,714 barrels.

In the following table the statistics are arranged by States, so far as permissible, and by districts. The term "active plant" is applied to a mill or group of mills situated at one place and operated by one company. If a company has establishments at different places its mill or group of mills at each place is counted as a plant. The districts are groups of States geographically and commercially related.

Portland cement produced, shipped, and in stock in the United States, 1928 and 1929, by States and districts

	Active plants		Production			Shipments							Stock (Dec. 31)		
			Barrels		Increase or decrease, 1929 (per cent)	1928		1929		Average factory value per barrel		Increase or decrease in quantity, 1929 (per cent)	Barrels		Increase or decrease, 1929 (per cent)
	1928	1929	1928	1929		Barrels	Value	Barrels	Value	1928	1929		1928 (revised)	1929	
STATE															
Alabama	6	6	6, 749, 202	5, 005, 967	−26	6, 696, 684	$8, 233, 872	5, 228, 947	$5, 911, 031	$1. 23	$1. 13	−22	743, 869	520, 889	−30
California	12	12	13, 555, 579	13, 091, 899	−3	13, 699, 851	25, 906, 942	12, 964, 746	22, 805, 576	1. 89	1. 76	−5	819, 914	947, 067	+16
Illinois	4	4	7, 334, 833	8, 242, 725	+12	7, 405, 667	11, 602, 848	7, 738, 208	11, 134, 538	1. 57	1. 44	+4	697, 441	1, 201, 958	+72
Iowa	6	6	7, 070, 172	6, 373, 330	−10	6, 880, 731	10, 734, 838	6, 586, 111	9, 781, 159	1. 56	1. 49	−4	1, 559, 925	1, 347, 144	−14
Kansas	7	7	6, 574, 219	6, 739, 741	+3	6, 787, 568	10, 091, 330	6, 855, 861	10, 041, 282	1. 49	1. 46	+1	911, 812	795, 602	−13
Michigan	14	14	13, 848, 561	13, 748, 862	−. 7	14, 044, 230	19, 268, 707	13, 325, 727	18, 916, 711	1. 37	1. 42	−5	2, 010, 520	2, 433, 655	+21
Missouri	5	5	7, 881, 118	8, 113, 304	+3	7, 943, 367	12, 367. 018	7, 984, 337	11, 557, 905	1. 56	1. 45	+5	896, 878	1, 025, 845	+14
New York	11	10	10, 960, 204	10, 761, 368	−2	10, 983, 950	16, 748, 773	10, 742, 992	15, 597, 868	1. 52	1. 45	−2	1, 504, 972	1, 523, 348	+1
Ohio	10	10	9, 233, 033	9, 427, 084	+2	9, 364, 338	14, 928, 183	9, 144, 085	13, 427, 778	1. 59	1. 47	−2	1, 074, 074	1, 357, 073	+26
Pennsylvania	26	27	41, 522, 401	39, 354, 470	−5	41, 161, 019	62, 572, 588	39, 309, 662	55, 600, 953	1. 52	1. 41	−4	5, 907, 235	5, 952, 043	+. 8
Tennessee	6	6	4, 689, 703	4, 442, 249	−5	4, 634, 280	6, 322, 213	4, 537, 601	5, 576, 235	1. 36	1. 23	−2	571, 018	475, 666	−17
Texas	7	9	6, 345, 604	7, 374, 428	+16	6, 231, 083	10, 938, 646	7, 083, 572	11, 805, 779	1. 76	1. 67	+14	521, 924	812, 780	+56
Other States [1]	42	47	40, 534, 217	37, 970, 609	−6	40, 005, 564	66, 256, 987	38, 366, 473	59, 996, 974	1. 66	1. 56	−4	5, 540, 521	5, 144, 657	−7
	156	163	176, 298, 846	170, 646, 036	−3	175, 838, 332	275, 972, 945	169, 868, 322	252, 153, 789	1. 57	1. 48	−3	22, 760, 103	23, 537, 817	+3
DISTRICT															
Eastern Pennsylvania, New Jersey, and Maryland	25	25	39, 677, 010	37, 726, 967	−5	39, 738, 910	60, 236, 388	37, 647, 014	53, 042, 469	1. 52	1. 41	−5	5, 113, 231	5, 193, 184	+2
New York and Maine	12	11	11, 484, 054	11, 418, 596	−1	11, 357, 052	17, 386, 416	11, 519, 619	16, 780, 423	1. 53	1. 46	+1	1, 655, 720	1, 554, 697	−6
Ohio, western Pennsylvania, and West Virginia	18	19	18, 326, 478	17, 936, 179	−2	18, 037, 131	28, 375, 472	17, 737, 226	25, 922, 200	1. 57	1. 46	−2	2, 835, 684	3, 034, 637	+7
Michigan	14	14	13, 848, 561	13, 748, 862	−. 7	14, 044, 230	19, 268, 707	13, 325, 727	18, 916, 711	1. 37	1. 42	−5	2, 010, 520	2, 433, 655	+21
Wisconsin, Illinois, Indiana, and Kentucky	11	11	22, 748, 604	21, 378, 418	−6	22, 627, 309	35, 575, 358	21, 171, 227	31, 168, 394	1. 57	1. 47	−6	2, 735, 536	2, 942, 727	+8
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	19	19	15, 949, 537	13, 792, 618	−14	15, 770, 338	21, 253, 288	14, 047, 259	17, 689, 012	1. 35	1. 26	−11	1, 895, 931	1, 641, 290	−13

[1] Includes Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

Portland cement produced, shipped, and in stock in the United States, 1928 and 1929, by States and districts—Continued

	Active plants		Production			Shipments							Stock (Dec. 31)		
			Barrels		Increase or decrease, 1929 (per cent)	1928		1929		Average factory value per barrel		Increase or decrease in quantity, 1929 (per cent)	Barrels		Increase or decrease, 1929 (per cent)
	1928	1929	1928	1929		Barrels	Value	Barrels	Value	1928	1929		1928 (revised)	1929	
DISTRICT—continued															
Eastern Missouri, Iowa, Minnesota, and South Dakota	12	12	16,692,696	15,697,414	−6	16,544,026	$25,777,858	15,984,176	$23,430,891	$1.56	$1.47	−3	2,882,044	2,595,282	−10
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas [2]	11	13	10,938,637	12,392,722	+13	11,221,802	17,444,193	12,267,352	18,124,275	1.55	1.48	+9	1,333,940	1,459,310	+9
Texas	7	9	6,345,604	7,374,428	+16	6,231,083	10,938,646	7,083,572	11,805,779	1.76	1.67	+14	521,924	812,780	+56
Colorado, Montana, Utah, Wyoming,[2] and Idaho [2]	7	9	2,771,863	2,695,024	−3	2,628,003	5,698,753	2,766,167	5,764,757	2.17	2.08	+5	527,508	456,365	−13
California	12	12	13,555,579	13,091,899	−3	13,699,851	25,906,942	12,964,746	22,805,576	1.89	1.76	−5	819,914	947,067	+16
Oregon and Washington	8	9	3,960,223	3,392,909	−14	3,938,597	8,110,924	3,354,237	6,703,302	2.06	2.00	−15	428,151	466,823	+9
	156	163	176,298,846	170,646,036	−3	175,838,332	275,972,945	169,868,322	252,153,789	1.57	1.48	−3	22,760,103	23,537,817	+3

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[2] Arkansas, Wyoming, and Idaho began producing and shipping in 1929.

The following table, which shows production, shipments, and stocks of finished Portland cement by districts and by months for 1929, with totals by months for 1928, has been compiled from monthly reports on the operation of all but two plants each month; estimates have been included for the latter. Although the figures only approximate the totals shown by other tables, which are based on final annual reports from the producers, they reflect accurately the fluctuations in the industry during the year. In December, January, and February, in the colder part of the United States, the production of Portland cement is necessarily somewhat curtailed by the weather, as are also demand and hence shipments from the mills. In addition, mills often close for repairs during the winter, when the demand is lowest. As the quantity of clinker or unground cement produced and in reserve at the mills awaiting manufacture into finished cement is of interest, the table appended shows these statistics, compiled from estimates by the manufacturers.

Summary of monthly estimates of Portland cement produced, shipped, and in stock at mills in the United States in 1929, by districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania, New Jersey, and Maryland	2,410	2,199	2,513	3,005	3,541	3,697	3,709	3,941	3,600	3,571	2,973	2,479
New York and Maine	405	412	593	900	1,137	1,197	1,366	1,449	1,241	1,129	848	731
Ohio, western Pennsylvania, and West Virginia	818	829	908	1,401	1,595	1,885	2,139	2,180	1,919	1,731	1,537	940
Michigan	703	525	476	964	1,387	1,466	1,432	1,582	1,519	1,437	1,228	1,008
Wisconsin, Illinois, Indiana, and Kentucky	1,047	862	1,086	1,903	2,065	2,305	2,354	2,425	2,182	1,935	1,760	1,445
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	884	887	1,028	1,117	1,276	1,279	1,250	1,450	1,298	1,306	1,085	905
Eastern Missouri, Iowa, Minnesota, and South Dakota	1,198	678	644	1,150	1,548	1,607	1,570	1,578	1,670	1,718	1,344	993
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas [1]	614	482	620	953	1,117	1,089	1,159	1,430	1,422	1,331	1,176	976
Texas	466	399	527	622	655	554	701	707	707	777	661	593
Colorado, Montana, Utah, Wyoming,[1] and Idaho [1]	50	74	57	307	363	325	322	357	314	323	120	84
California	1,034	1,071	1,170	1,085	1,042	1,110	991	1,128	967	1,179	1,091	913
Oregon and Washington	252	104	347	343	325	289	322	358	384	294	230	148
United States, 1929	9,881	8,522	9,969	13,750	16,151	16,803	17,315	18,585	17,223	16,731	14,053	11,215
1928	9,768	8,797	10,223	13,468	17,308	17,497	17,474	18,759	17,884	17,533	15,068	12,189
SHIPMENTS												
Eastern Pennsylvania, New Jersey, and Maryland	1,387	1,354	2,506	3,164	3,967	4,201	4,171	4,584	3,924	4,043	2,949	1,366
New York and Maine	257	232	504	732	1,184	1,383	1,609	1,747	1,434	1,407	738	294
Ohio, western Pennsylvania, and West Virginia	430	442	869	1,274	1,660	2,046	2,282	2,464	2,386	2,176	1,197	511
Michigan	266	302	543	897	1,322	1,720	1,950	2,290	1.800	1,323	667	246
Wisconsin, Illinois, Indiana, and Kentucky	313	373	948	1,608	2,356	2,706	2,837	3,275	2,759	2,346	1,219	429
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	824	662	960	1,251	1,301	1,285	1,543	1,644	1,311	1,419	1,025	821
Eastern Missouri, Iowa, Minnesota, and South Dakota	189	215	700	1,086	1,649	2,123	2,223	2,589	2,325	1,870	742	273
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas [1]	349	311	905	1,034	1,007	1,126	1,382	1,773	1,542	1,508	788	529
Texas	458	416	594	625	563	579	666	786	681	743	523	450
Colorado, Montana, Utah, Wyoming,[1] and Idaho [1]	61	57	144	266	334	336	299	368	358	346	119	81
California	1,033	984	1,148	1,058	1,066	1,113	995	1,123	1,023	1,183	1,038	813
Oregon and Washington	140	100	292	330	297	331	362	409	407	331	217	138
United States, 1929	5,707	5,448	10,113	13,325	16,706	18,949	20,319	23,052	19,950	18,695	11,222	5,951
1928	6,541	6,563	10,135	13,307	18,986	18,421	19,901	21,970	20,460	19,836	11,951	7,384

STOCKS (END OF MONTH)												
Eastern Pennsylvania, New Jersey, and Maryland	6,087	6,933	6,941	6,781	6,355	5,852	5,389	4,777	4,452	4,000	4,020	5,193
New York and Maine	1,804	1,984	2,073	2,242	2,195	2,009	1,765	1,467	1,274	996	1,107	1,555
Ohio, western Pennsylvania, and West Virginia	3,224	3,611	3,650	3,777	3,711	3,578	3,435	3,152	2,685	2,240	2,580	3,035
Michigan	2,435	2,658	2,591	2,659	2,724	2,469	1,979	1,238	961	1,075	1,636	2,434
Wisconsin, Illinois, Indiana, and Kentucky	3,423	3,911	4,049	4,343	4,052	3,650	3,168	2,318	1,740	1,329	1,869	2,943
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	1,955	2,180	2,248	2,114	2,117	2,111	1,818	1,623	1,610	1,498	1,557	1,641
Eastern Missouri, Iowa, Minnesota, and South Dakota	3,891	4,353	4,297	4,362	4,261	3,745	3,092	2,081	1,426	1,273	1,876	2,595
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas[1]	1,610	1,782	1,497	1,416	1,527	1.492	1,269	926	798	621	1,009	1,459
Texas	530	513	446	443	535	510	546	466	492	527	670	813
Colorado, Montana, Utah, Wyoming,[1] and Idaho[1]	524	541	451	492	521	506	529	518	475	451	453	456
California	785	871	894	921	997	995	991	997	941	937	991	947
Oregon and Washington	529	533	587	601	629	588	544	493	471	434	445	467
United States, 1929	26,797	29,870	29,724	30,151	29,624	27,505	24,525	20,056	17,325	15,381	18,213	23,538
1928	25,116	27,349	27,445	27,627	25,984	25,029	22,580	19,374	16,799	14,579	17,769	[2]22,760

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[1] The inclusion of Wyoming begins with April, 1929; of Idaho with June, 1929; of Arkansas with September, 1929.
[2] Revised figures.

Summary of monthly estimates of clinker (unground Portland cement) produced and in stock at mills in the United States in 1929, by districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December	Year
PRODUCTION													
Eastern Pennsylvania, New Jersey, and Maryland	2,824	2,899	2,958	3,100	3,463	3,397	3,314	3,544	3,250	3,202	2,821	2,527	37,299
New York and Maine	585	479	778	953	1,089	1,045	1,108	1,114	1,023	1,045	935	895	11,049
Ohio, western Pennsylvania, and West Virginia	1,121	1,102	1,213	1,394	1,591	1,683	1,772	1,742	1,624	1,578	1,577	1,295	17,692
Michigan	913	733	740	1,122	1,229	1,242	1,287	1,339	1,239	1,350	1,255	1,129	13,578
Wisconsin, Illinois, Indiana, and Kentucky	1,617	1,630	1,793	1,890	1,946	2,023	1,851	1,788	1,731	1,779	1,840	1,659	21,547
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	1,076	1,177	1,146	1,045	1,143	1,195	1,118	1,240	1,157	1,205	1,066	986	13,554
Eastern Missouri, Iowa, Minnesota, and South Dakota	1,276	923	926	1,234	1,491	1,457	1,411	1,384	1,551	1,657	1,260	1,076	15,646
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas [1]	715	648	724	929	1,094	1,036	1,072	1,216	1,276	1,281	1,147	967	12,105
Texas	456	430	554	613	617	587	652	770	712	793	731	686	7,601
Colorado, Montana, Utah, Wyoming,[1] and Idaho [1]	101	84	188	343	323	319	252	263	263	283	116	56	2,591
California	1,053	930	1,079	1,119	1,067	1,052	1,122	1,121	1,020	1,059	1,088	1,070	12,780
Oregon and Washington	275	220	351	424	391	276	255	308	319	283	251	193	3,546
United States, 1929	12,012	11,255	12,450	14,166	15,444	15,312	15,214	15,829	15,165	15,515	14,087	12,539	168,988
1928	11,839	11,363	12,501	13,844	16,025	15,940	15,981	16,202	15,909	15,782	14,930	13,426	173,742
STOCKS (END OF MONTH)													
Eastern Pennsylvania, New Jersey, and Maryland	1,344	2,063	2,526	2,648	2,616	2,361	2,003	1,653	1,297	962	891	1,030	--------
New York and Maine	1,080	1,153	1,347	1,413	1,382	1,249	1,014	704	507	441	540	605	--------
Ohio, western Pennsylvania, and West Virginia	1,189	1,469	1,781	1,790	1,804	1,636	1,293	878	607	478	537	933	--------
Michigan	876	1,089	1,354	1,521	1,376	1,167	1,034	804	538	465	502	625	--------
Wisconsin, Illinois, Indiana, and Kentucky	1,002	1,769	2,477	2,470	2,356	2,084	1,591	967	512	367	442	652	--------
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	995	1,292	1,418	1,358	1,232	1,152	1,021	816	686	603	593	664	--------
Eastern Missouri, Iowa, Minnesota, and South Dakota	566	817	1,102	1,199	1,157	1,024	869	667	562	499	430	534	--------
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas [1]	530	696	796	774	751	705	624	414	250	208	184	182	--------
Texas	145	182	216	216	187	228	188	255	268	293	372	474	--------
Colorado, Montana, Utah, Wyoming,[1] and Idaho [1]	395	405	536	573	533	528	459	365	314	274	270	243	--------
California	1,219	1,082	967	1,004	933	878	1,010	1,005	1,060	944	945	1,105	--------
Oregon and Washington	301	419	428	513	584	575	513	467	408	400	428	479	--------
United States, 1929	9,642	12,436	14,948	15,479	14,911	13,587	11,619	8,995	7,009	5,934	6,134	7,526	--------
1928	9,672	12,237	14,463	15,002	14,329	12,944	11,707	9,357	7,566	5,944	5,953	7,422	--------

[1] The inclusion of Wyoming begins with April, 1929; of Idaho with June, 1929; of Arkansas with September, 1929.

In 1929, as in 1928, producers' stocks of Portland cement reported on hand at the mills increased each month in comparison with the corresponding month in the preceding year. Reserves at the end of 1929 were 3 per cent higher than those at the end of 1928, exceeded the average for the five preceding years (19,689,108 barrels) by more than 19 per cent, and represented the largest stocks on hand at the end of any year since the beginning of the official statistical record of this item. The totals by States and districts are given in the preceding tables.

Producers' stocks of finished Portland cement on hand at mills in the United States, December 31, 1920–1929, in barrels

1920	8, 833, 067	1925	18, 336, 173
1921	12, 192, 567	1926	20, 740, 187
1922	9, 352, 250	1927	22, 457, 382
1923	10, 812, 639	1928	[2] 22, 760, 103
1924	14, 151, 695	1929	23, 537, 817

DOMESTIC CONSUMPTION

The total consumption of Portland cement in the United States may be estimated by adding the imports to the shipments and subtracting the exports from the sum. Of course, at any time a variable but considerable quantity of cement is in transit, in warehouses at distributing points, and awaiting use at jobs, so that the estimate thus made is at best only approximate. Another fact that impairs the accuracy of the estimate is that the cement imported and exported is classed as hydraulic cement; hence the records do not discriminate between Portland and other cements and probably include some plaster also. Portland cement, however, constitutes by far the greater part of the exports. The apparent domestic consumption in 1929 showed a decrease of nearly 4 per cent as compared with the consumption in 1928.

Portland cement available for consumption in the United States, 1920–1929, in barrels

Year	Shipments	Imports	Exports	Available for consumption
1920	96, 311, 719	524, 604	2, 985, 807	93, 850, 516
1921	95, 507, 147	122, 322	1, 181, 014	94, 448, 455
1922	117, 701, 216	323, 823	1, 127, 845	116, 897, 194
1923	135, 912, 118	1, 678, 636	1, 001, 688	136, 589, 066
1924	146, 047, 549	2, 010, 936	878, 543	147, 179, 942
1925	157, 295, 212	3, 655, 317	1, 019, 597	159, 930, 932
1926	162, 187, 090	3, 232, 386	974, 326	164, 445, 150
1927	171, 864, 728	2, 050, 180	816, 726	173, 098, 182
1928	175, 838, 332	2, 284, 085	824, 656	177, 297, 761
1929	169, 868, 322	1, 727, 900	885, 321	170, 710, 901

The only available gage of consumption of Portland cement by States is the record of shipments into the several States by the manufacturers and is therefore merely approximate. The shipments of cement into a State during a year do not equal the consumption in that State during the same year, but shipments over a long period should afford a fair index of consumption. The simplest available common unit is the estimated consumption in barrels per capita, which is obtained by comparing the shipments into the several States with the population of those States. The following table shows such figures for 1928 and 1929. The estimates of population used in calculating the per capita consumption are those of the Bureau of the Census.

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[2] Revised figures.

The official figures for exports of cement on page 418 differ from the exports reported by manufacturers in the following table, because cement forwarded from mills and destined for foreign countries and for Alaska, Hawaii, and Porto Rico is reported by the shipper as exported, whether or not it leaves the country during the calendar year, whereas the Bureau of Foreign and Domestic Commerce export figures record the cement that actually leaves the country during the period specified. (Shipments to Alaska, Hawaii, and Porto Rico appear on p. 418.) The exports for 1929 recorded by that bureau include all other hydraulic cement exported, whereas the table of per capita consumption relates only to Portland cement.

The per capita consumption indicated by the table necessarily falls short of the total apparent consumption by the quantity of the imports. These increase the consumption in certain States near the Canadian border and the seaboard; in 1929 they increased the general average per capita consumption by about 0.014 barrel.

In 29 States—16 east and 13 west of the Mississippi River—the per capita consumption in 1929 was 1 barrel or more. Two Southern States—Tennessee and Texas—are included in this class.

The highest per capita consumption in 1929 was that of Vermont—2.64 barrels; this State also showed the largest per capita increase—0.92 barrel. California, with 2.59 barrels in 1929, dropped from first place in 1928 to second in 1929. In three other States—Michigan, Iowa, and New Jersey—and in the District of Columbia the per capita consumption in 1929 was 2 barrels or more. After Vermont, the District of Columbia, Nevada, New Hampshire, Missouri, Texas, and Louisiana, in the order named, showed the largest increases in per capita consumption over 1928.

In comparison with the preceding year, all the States except Massachusetts showed changes in per capita consumption in 1929. Increases were recorded in 24 States; decreases were recorded in an equal number of States. The decreases in per capita consumption in 1929 ranged from 0.02 to 0.57 barrel. The general average per capita consumption for the United States was 1.41 barrels in 1929 as compared with 1.46 barrels in 1928. During the period 1914 to 1929 the average per capita consumption for the country has ranged from a low of 0.64 barrel (in 1918) to a high of 1.46 barrels (in 1928).

Shipments of domestic Portland cement from mills into States and per capita, 1928 and 1929, in barrels [1]

State	1928		1929	
	Total	Per capita	Total	Per capita
Alabama	2, 949, 527	1. 15	1, 958, 089	0. 76
Arizona [2]	692, 754	1. 46	656, 775	1. 39
Arkansas [3]	1, 251, 341	. 64	1, 555, 517	. 80
California	12, 453, 852	2. 73	11, 802, 278	2. 59
Colorado	1, 064, 945	. 98	891, 973	. 82
Connecticut [2]	2, 283, 726	1. 37	1, 908, 868	1. 15
Delaware [2]	348, 719	1. 43	365, 257	1. 50
District of Columbia [2]	889, 674	1. 61	1, 126, 946	2. 04
Florida	1, 325, 921	. 94	1, 176, 495	. 83
Georgia	1, 742, 530	. 54	1, 423, 359	. 44
Idaho [3]	294, 925	. 54	261, 378	. 48
Illinois	17, 683, 269	2. 39	13, 490, 520	1. 82
Indiana	5, 297, 337	1. 67	5, 674, 739	1. 79
Iowa	5, 348, 807	2. 20	5, 462, 534	2. 25
Kansas	2, 341, 459	1. 28	2, 605, 330	1. 42
Kentucky	1, 740, 245	. 68	1, 575, 715	. 62
Louisiana	1, 276, 127	. 65	1, 657, 154	. 85
Maine	522, 573	. 66	600, 423	. 76
Maryland	2, 242, 541	1. 39	2, 426, 107	1. 50
Massachusetts [2]	2, 916, 526	. 68	2, 908, 230	. 68
Michigan	11, 776, 282	2. 57	11, 686, 635	2. 55
Minnesota	3, 054, 583	1. 12	3, 212, 554	1. 18
Mississippi [2]	1, 128, 613	. 63	1, 028, 561	. 57
Missouri	4, 718, 602	1. 34	5, 620, 624	1. 60
Montana	461, 299	. 84	552, 357	1. 01
Nebraska	1, 195, 650	. 85	1, 470, 294	1. 04
Nevada [2]	106, 321	1. 37	133, 132	1. 72
New Hampshire [2]	515, 317	1. 13	665, 519	1. 46
New Jersey	8, 436, 886	2. 21	8, 015, 348	2. 10
New Mexico [2]	333, 250	. 84	286, 473	. 72
New York	22, 325, 087	1. 93	21, 039, 518	1. 82
North Carolina [2]	2, 401, 733	. 82	1, 753, 324	. 60
North Dakota [2]	454, 873	. 71	444, 798	. 69
Ohio	11, 017, 572	1. 61	10, 033, 158	1. 47
Oklahoma	3, 125, 602	1. 29	3, 352, 328	1. 38
Oregon	1, 257, 195	1. 39	1, 017, 434	1. 13
Pennsylvania	12, 996, 626	1. 32	13, 135, 444	1. 33
Rhode Island [2]	760, 813	1. 06	721, 352	1. 01
South Carolina [2]	1, 508, 279	. 81	1, 190, 008	. 64
South Dakota	491, 102	. 70	530, 455	. 75
Tennessee	2, 699, 338	1. 08	2, 934, 953	1. 17
Texas	6, 193, 925	1. 13	7, 584, 278	1. 38
Utah	507, 986	. 96	521, 047	. 98
Vermont [2]	605, 930	1. 72	928, 881	2. 64
Virginia	1, 995, 529	. 77	1, 764, 760	. 69
Washington	2, 974, 407	1. 87	2, 477, 520	1. 56
West Virginia	1, 360, 597	. 79	1, 415, 161	. 82
Wisconsin	5, 382, 421	1. 82	5, 517, 598	1. 87
Wyoming [3]	198, 194	. 80	192, 995	. 78
Unspecified	29, 916	----------	----------	----------
	174, 680, 726	1. 46	168, 754, 196	1. 41
Exports reported by manufacturers but not included above [4]	1, 157, 606	----------	1, 114, 126	----------
Total shipped from cement plants	175, 838, 332	----------	169, 868, 322	----------

[1] Per capita figures based on estimate of population made by the Bureau of the Census.
[2] Noncement-producing State.
[3] Arkansas, Idaho, and Wyoming began producing and shipping in 1929.
[4] Includes shipments to Alaska, Hawaii, and Porto Rico.

The following table, which shows the monthly shipments from Portland-cement mills into States in 1929, has been compiled from monthly reports of producers, but includes estimates of the distribution of shipments from three plants each month. Although the figures vary slightly from the totals shown in the other tables, which are based on final annual reports from the producers, they reflect the fluctuations in shipments during the year.

Portland cement shipped from mills into States in 1929, by months, in barrels[1]

Shipped to—	January	February	March	April	May	June
Alabama	125, 356	105, 162	127, 916	166, 925	172, 938	156, 828
Alaska	132	----------	525	1, 778	1, 641	1, 564
Arizona	55, 771	58, 844	57, 406	51, 150	57, 318	76, 157
Arkansas	47, 087	40, 599	93, 133	99, 392	98, 331	149, 067
California	950, 884	900, 811	1, 063, 895	973, 052	977, 113	981, 611
Colorado	27, 709	25, 474	59, 854	99, 991	106, 513	105, 289
Connecticut	57, 087	54, 574	106, 492	158, 992	202, 140	192, 236
Delaware	10, 183	14, 459	19, 112	31, 219	35, 091	45, 544
District of Columbia	60, 476	58, 207	86, 492	97, 218	109, 581	110, 966
Florida	93, 827	92, 217	100, 388	101, 227	105, 045	91, 946
Georgia	92, 494	73, 064	95, 061	139, 353	121, 684	117, 783
Hawaii	21, 829	20, 683	22, 366	24, 308	32, 262	22, 254
Idaho	3, 266	3, 792	20, 842	26, 923	35, 169	31, 802
Illinois	211, 984	251, 883	612, 069	1, 069, 018	1, 583, 290	1, 780, 688
Indiana	65, 421	87, 506	251, 934	365, 104	474, 599	635, 341
Iowa	17, 701	21, 406	123, 637	215, 629	579, 190	728, 393
Kansas	43, 008	56, 678	217, 559	285, 944	258, 378	229, 267
Kentucky	33, 118	32, 328	102, 241	163, 059	146, 423	164, 656
Louisiana	96, 054	81, 109	104, 285	105, 290	121, 576	113, 837
Maine	10, 011	15, 199	19, 229	34, 197	56, 851	65, 594
Maryland	60, 058	59, 087	131, 729	169, 575	235, 589	244, 635
Massachusetts	85, 539	79, 633	165, 380	226, 181	303, 692	293, 455
Michigan	247, 190	273, 538	474, 902	785, 443	1, 192, 634	1, 486, 439
Minnesota	30, 494	44, 013	136, 193	220, 077	348, 850	456, 148
Mississippi	83, 044	50, 254	75, 353	76, 425	79, 718	73, 548
Missouri	91, 914	109, 614	342, 697	405, 208	436, 246	567, 722
Montana	3, 525	5, 570	20, 068	49, 313	76, 909	82, 861
Nebraska	16, 113	15, 409	88, 438	106, 392	140, 036	152, 570
Nevada	6, 703	6, 905	9, 755	10, 848	16, 672	14, 091
New Hampshire	17, 988	17, 091	32, 824	42, 946	70, 122	73, 359
New Jersey	238, 270	247, 004	485, 067	689, 358	890, 487	909, 551
New Mexico	30, 915	16, 549	25, 796	33, 100	28, 894	32, 003
New York	746, 897	667, 767	1, 285, 742	1, 598, 671	2, 130, 573	2, 493, 401
North Carolina	108, 492	85, 373	159, 570	224, 791	222, 453	179, 957
North Dakota	2, 020	2, 502	16, 912	62, 207	58, 414	81, 746
Ohio	250, 972	253, 420	564, 820	849, 359	990, 025	1, 192, 848
Oklahoma	153, 893	112, 301	318, 321	309, 739	270, 643	286, 697
Oregon	33, 364	34, 873	80, 134	79, 593	94, 249	95, 717
Pennsylvania	378, 421	373, 929	716, 114	960, 745	1, 296, 266	1, 467, 886
Porto Rico	500	3, 745	420	975	300	2, 800
Rhode Island	16, 956	25, 497	43, 300	65, 457	80, 975	72, 067
South Carolina	96, 379	74, 035	100, 091	131, 517	139, 561	126, 369
South Dakota	4, 414	4, 361	32, 110	40, 519	54, 123	64, 846
Tennessee	96, 513	80, 026	140, 815	231, 259	248, 286	341, 140
Texas	482, 644	424, 778	621, 387	694, 150	622, 377	675, 511
Utah	13, 185	11, 850	28, 712	46, 663	67, 602	59, 003
Vermont	8, 794	14, 066	24, 984	33, 872	83, 862	130, 517
Virginia	86, 620	83, 678	138, 772	176, 266	190, 663	187, 160
Washington	111, 351	68, 792	214, 280	255, 250	208, 716	244, 546
West Virginia	33, 367	35, 675	70, 720	93, 098	115, 718	153, 996
Wisconsin	57, 769	74, 696	197, 738	352, 986	633, 405	786, 307
Wyoming	4, 216	3, 818	7, 672	12, 491	20, 364	27, 961
Unspecified	12, 410	47, 710	28, 531	20, 771	----------	21, 536
	5, 634, 328	5, 401, 554	10, 063, 783	13, 265, 014	16, 623, 557	18, 879, 216
Foreign countries	72, 672	46, 446	49, 217	59, 986	82, 443	69, 784
Total shipped from cement plants	5, 707, 000	5, 448, 000	10, 113, 000	13, 325, 000	16, 706, 000	18, 949, 000

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[1] Includes estimated distribution of shipments from 3 plants each month.

Portland cement shipped from mills into States in 1929, by months, in barrels—Con.

Shipped to—	July	August	September	October	November	December
Alabama	227,381	271,466	179,011	172,980	132,035	115,961
Alaska	2,307	2,105	282	662	396	962
Arizona	46,241	57,184	56,000	52,544	43,145	46,831
Arkansas	181,615	187,688	206,476	190,656	133,371	84,761
California	905,437	1,007,181	915,829	1,075,308	943,641	728,509
Colorado	107,528	105,397	91,602	97,352	32,910	32,359
Connecticut	213,551	241,126	206,737	229,221	178,005	62,419
Delaware	43,016	56,135	34,281	36,005	28,275	11,737
District of Columbia	118,426	125,732	107,654	104,051	96,757	44,485
Florida	99,338	100,975	88,730	106,271	111,127	84,792
Georgia	157,113	160,279	117,262	124,215	121,871	101,776
Hawaii	21,348	26,037	24,896	22,716	26,788	19,772
Idaho	33,383	26,051	27,375	28,709	17,468	6,642
Illinois	1,835,790	1,969,576	1,721,624	1,406,895	782,779	263,469
Indiana	745,533	990,059	909,295	686,986	326,534	108,261
Iowa	809,784	1,108,711	968,958	716,047	127,446	35,737
Kansas	225,611	338,052	332,819	336,060	159,803	105,763
Kentucky	187,060	205,597	176,115	178,287	107,310	46,660
Louisiana	117,311	172,697	171,673	245,643	152,054	171,845
Maine	73,594	79,258	94,201	80,564	52,865	19,014
Maryland	305,219	323,021	294,089	291,625	233,983	79,751
Massachusetts	335,635	365,297	356,318	365,195	225,482	101,340
Michigan	1,677,282	1,891,753	1,601,684	1,161,054	588,511	224,563
Minnesota	478,941	533,434	430,298	352,958	130,411	52,991
Mississippi	109,161	131,963	107,651	99,934	71,069	64,336
Missouri	725,967	896,327	748,870	681,598	396,019	142,398
Montana	67,366	89,417	77,505	55,468	16,035	8,041
Nebraska	150,214	270,919	224,168	213,158	61,548	33,088
Nevada	10,841	12,186	14,180	15,028	8,173	8,279
New Hampshire	98,708	116,275	75,573	67,001	37,526	13,915
New Jersey	877,662	958,357	825,204	911,203	678,291	281,867
New Mexico	25,281	29,932	21,621	28,479	15,557	10,437
New York	2,596,425	2,768,232	2,237,801	2,295,014	1,441,207	722,146
North Carolina	171,148	149,085	129,411	147,399	110,928	66,152
North Dakota	69,425	47,870	49,597	42,474	9,564	2,161
Ohio	1,236,231	1,364,665	1,207,197	1,218,439	638,120	253,060
Oklahoma	323,528	371,205	365,927	376,193	261,283	213,739
Oregon	101,161	124,852	122,669	114,228	78,363	49,698
Pennsylvania	1,565,726	1,710,648	1,632,356	1,550,799	1,022,410	435,580
Porto Rico	7,702	6,995	4,190	5,195	3,520	4,500
Rhode Island	73,134	101,278	81,919	78,405	58,690	24,096
South Carolina	140,609	89,733	64,446	88,492	70,756	67,813
South Dakota	61,786	55,114	83,173	94,859	22,438	12,744
Tennessee	405,704	441,869	328,182	330,340	166,367	121,691
Texas	771,695	877,463	697,091	759,309	507,441	428,688
Utah	43,737	57,547	73,952	60,619	37,616	23,560
Vermont	145,097	181,612	135,894	109,422	43,012	17,560
Virginia	194,236	205,771	161,521	152,804	120,589	68,406
Washington	263,893	310,711	305,056	240,543	158,675	101,062
West Virginia	194,649	209,590	164,543	168,957	103,156	50,471
Wisconsin	823,678	952,914	759,187	597,697	224,480	80,278
Wyoming	21,230	26,480	24,015	28,708	9,346	6,690
Unspecified	40,750	89,633	52,207	28,000	32,290	14,500
	20,265,188	22,993,454	19,888,315	18,621,769	11,157,436	5,877,356
Foreign countries	53,812	58,546	61,685	73,231	64,564	73,644
Total shipped from cement plants	20,319,000	23,952,000	19,950,000	18,695,000	11,222,000	5,951,000

LOCAL SUPPLIES

The following table compares the shipments from the mills within a State or group of States with the estimated consumption (State receipts of mill shipments) and indicates the surplus or deficiency in the supply of cement locally available. Consumption in the States that do not produce cement is also indicated in the table on page 401. Data for 1916 to 1927 will be found in Mineral Resources of the United States for 1917 to 1927.

The surplus shown in the following table was distributed by years, as follows: In 1928, to noncement-producing States, 16,690,988 barrels; to foreign countries and to Alaska, Hawaii, and Porto Rico, 1,157,606 barrels; unspecified, 29,916 barrels. In 1929, to noncement-producing States, 14,118,124 barrels; to foreign countries and to Alaska, Hawaii, and Porto Rico, 1,114,126 barrels.

Estimated surplus or deficiency in local supply of Portand cement in cement-producing States, 1928 and 1929, in barrels

State or division	1928			1929		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	6, 696, 684	2, 949, 527	+3, 747, 157	5, 228, 947	1, 958, 089	+3, 270, 858
California	13, 699, 851	12, 453, 852	+1, 245, 999	12, 964, 746	11, 802, 278	+1, 162, 468
Illinois	7, 405, 667	17, 683, 269	−10, 277, 602	7, 738, 208	13, 490, 520	−5, 752, 312
Iowa	6, 880, 731	5, 348, 807	+1, 531, 924	6, 586, 111	5, 462, 534	+1, 123, 577
Kansas	6, 787, 568	2, 341, 459	+4, 446, 109	6, 855, 861	2, 605, 330	+4, 250, 531
Michigan	14, 044, 230	11, 776, 282	+2, 267, 948	13, 325, 727	11, 686, 635	+1, 639, 092
Missouri	7, 943, 367	4, 718, 602	+3, 224, 765	7, 984, 337	5, 620, 624	+2, 363, 713
Ohio	9, 364, 338	11, 017, 572	−1, 653, 234	9, 144, 085	10, 033, 158	−889, 073
Pennsylvania	41, 161, 019	12, 996, 626	+28, 164, 393	39, 309, 662	13, 135, 444	+26, 174, 218
Tennessee	4, 634, 280	2, 699, 338	+1, 934, 942	4, 537, 601	2, 934, 953	+1, 602, 648
Texas	6, 231, 083	6, 193, 925	+37, 158	7, 083, 572	7, 584, 278	−500, 706
Colorado, Montana, Utah, Wyoming,[1] and Idaho[1]	2, 628, 003	2, 034, 230	+593, 773	2, 766, 167	2, 419, 750	+346, 417
Oregon and Washington	3, 938, 597	4, 231, 602	−293, 005	3, 354, 237	3, 494, 954	−140, 717
Georgia, Kentucky, Virginia, Florida, and Louisiana	5, 283, 676	8, 080, 352	−2, 796, 676	4, 995, 767	7, 597, 483	−2, 601, 716
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas[1]	20, 531, 502	18, 546, 695	+1, 984, 807	19, 543, 182	21, 313, 485	−1, 770, 303
Maryland, New Jersey, and West Virginia	7, 250, 684	12, 040, 024	−4, 789, 340	6, 930, 493	11, 856, 616	−4, 926, 123
New York and Maine	11, 357, 052	22, 847, 660	−11, 490, 608	11, 519, 619	21, 639, 941	−10, 120, 322
	175, 838, 332	157, 959, 822	+17, 878, 510	169, 868, 322	154, 636, 072	+15, 232, 250

[1] Wyoming, Idaho, and Arkansas began producing and shipping in 1929.

PRICES

AT FACTORIES

The average selling value of Portland cement f. o. b. at the factories with the price of containers not included and with cash discounts deducted where allowed, as reported to the Bureau of Mines, is shown in the table of shipments by States and districts during 1928 and 1929 (p. 393). The averages by districts ranged from $1.26 a barrel in the Virginia-Tennessee-Alabama-Georgia-Florida-Louisiana district to $2.08 a barrel in the Colorado-Montana-Utah-Wyoming-Idaho district in 1929, as compared with a range from $1.35 a barrel in the Virginia-Tennessee-Alabama-Georgia-Florida-Louisiana district to $2.17 a barrel in the Colorado-Montana-Utah district in 1928. The general average value for the country as a whole decreased 9 cents per barrel, or nearly 6 per cent, in 1929, and averages were lower in all the districts except Michigan and in all the States shown in the table except Michigan.

For certain States the average factory value of Portland cement may be higher than it would be if the ordinary structural cement were the only kind considered. For these States certain special cements that command higher prices are included in the average. These special cements include the white Portland cement made in Pennsylvania and, in 1927 and 1928, in Tennessee and the plastic and waterproofed Portland cements. No output of white Portland cement was reported from Tennessee for 1929, and its manufacture in that State has been reported discontinued. The manufacture in California of cement characterized as plastic and waterproof and intended particularly for certain uses, such as shutting out water in oil wells, has been noted for some years in previous issues of this report. In 1927, the first year for which an attempt was made by the Bureau of Mines to collect separate statistics of special Portland cements, the manufacture and marketing of cement of marked plasticity and waterproofing qualities was reported in a number of other States. Statistics of output of plastic and waterproofed, high-early strength, and quick-hardening Portland cements as reported by the producers for 1928 and 1929 show increased use of these cements. See table on page 413.

Average factory value per barrel in bulk of Portland cement, 1918–1929

1918	$1.60	1922	$1.76	1926	$1.71
1919	1.71	1923	1.90	1927	1.62
1920	2.02	1924	1.81	1928	1.57
1921	1.89	1925	1.77	1929	1.48

AT MARKETS

As the annual per capita consumption of Portland cement in the United States has reached nearly 1½ barrels, the prices of such an essential building material have attracted particular interest. Considerable information is now available to show the position of cement prices among those of other structural materials and to explain the economic conditions that determine them. Data of interest in this connection are now compiled and published by the United States Department of Labor, Bureau of Labor Statistics.

Comparative prices of building materials in December, 1928 and 1929 [1]

[Percentage of increase or decrease from 1926 average]

	1928	1929
Building materials in general	−3.2	−3.8
Lime, building, at plant (composite price)	−5.8	−12.1
Plate glass, 3 to 5 feet, New York	−12.1	−12.1
Turpentine, New York	−34.7	−42.6
Brick, common, building, at plant (composite price)	−2.1	−2.6
Linseed oil, raw, New York	−9.6	+32.0
Douglas fir, No. 1, common, at mills	−.6	+2.2
Yellow pine, flooring, at mills	−17.6	−15.8
Oak, plain white, No. 1, Cincinnati	−9.1	−17.0
Portland cement, at plant (composite price)	−5.4	−10.8

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[1] U. S. Department of Labor, Bureau of Labor Statistics, Wholesale Prices of Commodities: Report for December, 1929, pp. 9–10.

MANUFACTURING CONDITIONS

PLANTS

Portland cement was manufactured at and shipments were made from 163 plants in 1929, as compared with 155 producing and 156 shipping plants in 1928. One plant that was active in 1928 produced no cement in 1929. Four plants that were idle in 1928 were also reported idle in 1929; two of these were reported out of business in 1929. Eight new plants, seven of which are wet-process plants, produced clinker and finished Portland cement in 1929. In addition, the Blue Diamond Co. placed a plant in operation in 1929 at Los Angeles, Calif., to manufacture finished cement from purchased clinker, the first plant of its kind in the United States. The eight new plants were equipped at the end of 1929 as follows:

Arkansas Portland Cement Co., plant at Okay, Howard County, Ark. Wet process: Limestone and shale; clinker burned with natural gas and coal; one 11½ by 300 foot kiln; reported daily clinker capacity, 2,000 barrels.

Idaho Portland Cement Co., plant at Inkom, Idaho. Wet process: Limestone and shale; clinker burned with coal; one 10 by 200 foot kiln; reported daily clinker capacity, 1,500 barrels.

Ash Grove Lime & Portland Cement Co., plant at Louisville, Cass County, Nebr. Wet process: Limestone, cement rock, clay and shale; clinker burned with coal; two 9⅛ to 10⅙ by $276\frac{1}{12}$ foot kilns; reported daily clinker capacity, 3,000 barrels.

Davison Coke & Iron Co., Neville Island, Allegheny County, Pa. Wet process: Limestone and slag; clinker burned with coal and coke-oven gas; waste-heat installation; two 10 by 175 foot kilns; reported daily clinker capacity, 3,600 barrels.

Republic Portland Cement Co., plant at Longhorn, Bexar County, Tex. Wet process: Cement rock; clinker burned with natural gas; two 11 by 250 foot kilns; reported daily clinker capacity, 3,500 barrels.

Atlas Portland Cement Co. (of Texas), plant at Waco, McLennan County, Tex. Dry process: Limestone and shale; clinker burned with natural gas; one 11 by 225 foot kiln; reported daily clinker capacity, 2,400 barrels.

Pacific Coast Cement Co., plant at Seattle, King County, Wash. Wet process: Limestone and clay; clinker burned with coal; two 11¼ by 240 foot kilns; reported daily clinker capacity, 3,600 barrels.

Monolith-Portland Midwest Co., plant at Laramie, Albany County, Wyo. Wet process: Cement rock; clinker burned with coal; one 10 to $11\frac{3}{10}$ by 341 foot kiln; reported daily clinker capacity, 1,800 barrels.

Additional plants were reported under construction but not completed in 1929 in Arkansas, California, and Texas.

RAW MATERIALS

In the following table the production of Portland cement in the United States is classified according to the kinds of raw materials from which the cement is manufactured. The production is grouped as follows:

Type 1 includes cement produced from argillaceous limestone ("cement rock") or from a mixture of cement rock with pure limestone. Under this type of manufacture are included all the cement plants of the Lehigh district of Pennsylvania and New Jersey and a few plants in certain other States.

Type 2 includes cement made from a mixture of comparatively pure limestone with clay or shale. This mixture is used at the majority of plants in the United States. In 1929 three plants reported the use of oyster shells and clay in the output, which is included in type 2.

Type 3 includes cement manufactured from a mixture of marl and clay. This type of mixture has been used in certain plants in Michigan, Ohio, Indiana, New York, Utah, and Virginia, and in 1929 was used in all these States except New York.

Type 4 includes cement manufactured from a mixture of limestone and blast-furnace slag.

The table shows increases in 1929 as compared with 1926 in the relative production from cement rock (type 1), from marl (type 3), and from slag (type 4) and a corresponding decrease in the production from limestone (type 2).

Production and percentage of total output of Portland cement in the United States according to type of material used, 1898–1914, 1926, and 1929

Year	Type 1. Cement rock and pure limestone		Type 2. Limestone and clay or shale		Type 3. Marl and clay		Type 4. Blast-furnace slag and limestone	
	Barrels	Percentage	Barrels	Percentage	Barrels	Percentage	Barrels	Percentage
1898	2,764,694	74.9	365,408	9.9	562,092	15.2	----------	----------
1899	4,010,132	70.9	546,200	9.7	1,095,934	19.4	----------	----------
1900	5,960,739	70.3	1,034,041	12.2	1,454,797	17.1	32,443	0.4
1901	8,503,500	66.9	2,042,209	16.1	2,001,200	15.7	164,316	1.3
1902	10,953,178	63.6	3,738,303	21.7	2,220,453	12.9	318,710	1.8
1903	12,493,694	55.9	6,333,403	28.3	3,052,946	13.7	462,930	2.1
1904	15,173,391	57.2	7,526,323	28.4	3,332,873	12.6	473,294	1.8
1905	18,454,902	52.4	11,172,389	31.7	3,884,178	11.0	1,735,343	4.9
1906	23,896,951	51.4	16,532,212	35.6	3,958,201	8.5	2,076,000	4.5
1907	25,859,095	53.0	17,190,697	35.2	3,606,598	7.4	2,129,000	4.4
1908	20,678,693	40.6	23,047,707	45.0	2,811,212	5.5	4,535,300	8.9
1909	24,274,047	37.3	32,219,365	49.6	2,711,219	4.2	5,786,800	8.9
1910	26,520,911	34.6	39,720,320	51.9	3,307,220	4.3	7,001,500	9.2
1911	26,812,129	34.1	40,665,332	51.8	3,314,176	4.2	7,737,000	9.9
1912	24,712,780	30.0	44,607,776	54.1	2,467,368	3.0	10,650,172	12.9
1913	29,333,490	31.8	47,831,863	51.9	3,734,778	4.1	11,197,000	12.2
1914	24,907,047	28.2	50,168,813	56.9	4,038,310	4.6	9,116,000	10.3
1926	44,090,657	26.8	[1] 101,637,866	61.8	3,324,408	2.0	15,477,239	9.4
1929	51,077,034	29.9	[1] 97,623,502	57.2	4,832,700	2.9	17,112,800	10.0

[1] Includes output of 2 plants in 1926 and 3 plants in 1929 using oyster shells and clay.

The producers reported as entering into the manufacture of 170,646,036 barrels, or 32,081,455 short tons, of Portland cement in the United States in 1929 approximately 53,923,000 short tons of raw materials, as follows: 43,292,000 tons of limestone and cement rock, 5,066,000 tons of clay and shale, 1,331,000 tons of blast-furnace slag, 1,466,000 tons of marl, 1,210,000 tons of gypsum, and 1,558,000 tons of other materials, such as oyster shells, sand, and ashes.

FUELS[3]

In comparison with 1928, the 1929 figures show decreases in the percentage of cement burned by coal alone and in that burned by oil and an increase in the percentage burned by natural gas. Of the Portland cement produced in 1929, 77.1 per cent was burned with coal alone, as compared with 79.5 per cent in 1928; 4.4 per cent was burned with oil alone, as compared with 7.4 per cent in 1928; and 3.5 per cent was burned with natural gas alone, as compared with 2.8 per cent in 1928.

As summarized from the reports of the cement producers, the following quantities of fuel were consumed at the Portland-cement plants in the United States in 1929 in the production of 170,646,036 barrels of finished cement: Coal, 9,340,434 short tons; oil, 2,533,911 barrels (or 106,424,262 gallons); and natural gas, 41,643,433,045 cubic feet. Corresponding figures from the producers' reports for 1928 are as follows: Finished cement produced, 176,298,846 barrels; fuels consumed in its manufacture—coal, 9,802,431 short tons; oil, 3,508,038 barrels (or 147,337,596 gallons); and natural gas, 30,660,348,200 cubic feet. In the estimates of consumption of fuel per barrel of cement the production of finished cement alone is considered. In this connection it is of interest that the stock of clinker or unground cement at the mills at the end of 1929—7,526,000 barrels—as shown in the tables on pages 398 and 410 was only slightly in excess of the stock of clinker at the mills at the end of 1928—7,422,000 barrels.

Coal was reported as the only fuel used at 125 plants in the United States in 1929, as compared with 124 plants reporting the consumption of this fuel only in 1928. The apparent average consumption in 1929 was 132.3 pounds of coal per barrel of finished cement, as compared with 131.1 pounds of coal per barrel of finished cement in 1928. The 61 dry-process plants using coal as the only fuel in 1929 reported a total consumption of 4,939,438 short tons of coal in the manufacture of 77,474,985 barrels of finished cement, or an average consumption of 127.5 pounds of coal per barrel of finished cement, as compared with the consumption in 1928 at 64 dry-process plants, where coal was reported as the only fuel used, of 5,536,526 short tons of coal in the manufacture of 90,769,258 barrels of finished cement, or an average consumption of 122 pounds of coal per barrel of finished cement.

Sixty-four wet-process plants reported the use of coal alone as fuel in 1929, with a total consumption of 3,767,152 short tons in the manufacture of 54,160,610 barrels of finished cement, or an average consumption of 139.1 pounds of coal per barrel of finished cement. In 1928, 60 wet-process plants reported the use of coal alone as fuel, with a total consumption of 3,650,394 short tons of coal in the manufacture of 49,335,412 barrels of finished cement, or an average consumption of 148 pounds of coal per barrel of finished cement.

Ten plants, all in the Pacific Coast States, reported the use of oil alone as fuel in 1929, with a total consumption of 2,006,596 barrels in the manufacture of 7,535,579 barrels of finished cement, or an average of 0.2663 barrel (about 11 gallons) per barrel of finished cement; in other words, 1 barrel of oil burned more than 3.7 barrels of cement. The average consumption of oil by the dry-process plants was 0.2433 barrel (or about 10 gallons) per barrel of finished cement and by the wet-process plants 0.2746 barrel (11.5 gallons) per barrel of finished cement. The use of oil in 1929 was reported at 15 additional plants, which also used other fuel; 3 of these plants are east and 12 west of the Mississippi River. Thirteen plants, all in the Pacific Coast States, reported the use of oil alone as fuel in 1928, with a total consumption of 3,263,537 barrels in the manufacture of 13,078,031 barrels of finished cement, or an average of 0.2495 barrel (about 10.5 gallons) per barrel of finished cement; expressed in other words, 1 barrel of oil burned more than 4 barrels of cement. The average consumption of oil by the dry-process plants was 0.2369 barrel (or about 10 gallons) per barrel of finished cement and by the wet-process plants 0.2660 barrel (11.2 gallons) per barrel of finished cement. The use of oil in 1928 was reported at 10 additional plants, which also used other fuel; 3 of these plants are east and 7 west of the Mississippi River.

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[3] The statistics on fuels in 1929 include estimated consumption of fuel for 1 plant which manufactures from purchased clinker only

Seven plants reported natural gas as the only fuel used in 1929, as compared with 6 plants so reporting in 1928. The average consumption in 1929 was 2,008.1 cubic feet of gas per barrel of finished cement; the corresponding figure for 1928 is 2,133.7 cubic feet per barrel of finished cement. The use of natural gas was reported by 17 additional plants, which also used other fuel in 1929, and by 9 additional plants, which also used other fuel in 1928.

Portland cement burned, 1928 and 1929, by kinds of fuel

Fuel	Finished cement produced			Fuel consumed		
	Number of plants	Barrels of 376 pounds	Per cent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (cubic feet)
1928						
Coal	124	[1] 140,104,670	79.5	[2] 9,186,920	----	----
Oil	13	[1] 13,078,031	7.4	----	[3] 3,263,537	----
Natural gas	6	[1] 4,918,561	2.8	----	----	10,494,609,200
Coal and oil	3	18,197,584	10.3	615,511	244,501	20,165,739,000
Coal and natural gas	2					
Oil and natural gas	3					
Coal, oil, and natural gas	4					
	155	176,298,846	100.0	[4] 9,802,431	3,508,038	30,660,348,200
1929						
Coal	125	[1] 131,635,595	77.1	[5] 8,706,590	----	----
Oil	10	[1] 7,535,579	4.4	----	2,006,596	----
Natural gas	7	[1] 5,941,147	3.5	----	----	11,930,600,000
Coal and oil	4	25,533,715	15.0	633,844	527,315	29,712,833,045
Coal and natural gas	6					
Oil and natural gas	7					
Coal, oil, and natural gas	4					
	163	170,646,036	100.0	[6] 9,340,434	2,533,911	41,643,433,045

[1] Average consumption of fuel per barrel of cement produced was as follows: 1928—Coal, 131.1 pounds; oil, 0.2495 barrel; natural gas, 2,133.7 cubic feet. 1929—Coal, 132.3 pounds; oil, 0.2663 barrel; natural gas, 2,008.1 cubic feet.

[2] In addition to the coal shown for this group, 1 of the plants reports using some petroleum coke with coal.

[3] In addition to the oil shown for this group, 1 of the plants reports using some petroleum coke with oil.

[4] Includes 210,390 short tons of anthracite and 9,592,041 short tons of bituminous coal.

[5] In addition to the coal shown for this group, 1 of the plants reports using manufactured gas with coal.

[6] Includes 204,084 short tons of anthracite, 9,114,391 short tons of bituminous coal, and 21,959 short tons of lignite.

The following table shows the total fuels used and the finished cement produced by the wet and dry processes in 1928 and 1929:

Portland cement burned and fuels used, 1928 and 1929, by processes

Process	Finished cement produced			Fuel consumed		
	Number of plants[1]	Barrels	Per cent of total	Coal (short tons)	Oil (barrels)	Natural gas (cubic feet)
1928						
Wet	80½	67,209,923	38.1	3,805,151	1,586,078	20,837,560,400
Dry	74½	109,088,923	61.9	[2] 5,997,280	[3] 1,921,960	9,822,787,800
	155	176,298,846	100.0	[4] 9,802,431	3,508,038	30,660,348,200
1929						
Wet	88½	73,636,889	43.2	[5] 3,934,032	1,821,690	23,184,018,063
Dry	74½	97,009,147	56.8	5,406,402	712,221	18,459,414,982
	163	170,646,036	100.0	[6] 9,340,434	2,533,911	41,643,433,045

[1] A wet mill and a dry mill in 1 plant are each counted as half a plant.

[2] In addition to the coal shown for this group, 1 of the plants reports using some petroleum coke with coal.

[3] In addition to the oil shown for this group, 1 of the plants reports using some petroleum coke with oil.

[4] Includes 210,390 short tons of anthracite and 9,592,041 short tons of bituminous coal.

[5] In addition to the coal shown for this group, 1 of the plants reports using manufactured gas with coal.

[6] Includes 204,084 short tons of anthracite, 9,114,391 short tons of bituminous coal, and 21,959 short tons of lignite.

Estimated clinker (unground cement) produced and in stock at mills in the United States, 1928 and 1929, by processes, in barrels

Process	Number of plants[1]		Production		Stock (Dec. 31)	
	1928	1929	1928	1929	1928	1929
Wet	80½	88½	66,284,000	73,221,000	3,122,000	3,745,000
Dry	74½	71½	107,458,000	95,767,000	4,300,000	[2] 3,781,000
	155	160	173,742,000	168,988,000	7,422,000	[2] 7,526,000

[1] A wet mill and a dry mill in 1 plant are each counted as half a plant.

[2] Includes some stock at 2 plants which report no manufacture of clinker in 1929.

CAPACITY

The capacity at the end of 1929 for production of finished Portland cement of the 163 plants active in 1929 and 3 plants inactive in 1929 but producing within the two previous years, according to manufacturers' reports supplemented by a few estimates, was 258,917,000 barrels per year. This total includes, besides the increased capacity due to extensions and improvements at old plants, approximately 8,057,000 barrels capacity for finished Portland cement of the 9 new plants that began operating during the year. The capacity of 2 plants reported idle and out of business in 1929 and idle in 1928 has been excluded from the figures for 1929. The total production for 1929 was 65.9 per cent of the indicated capacity, based on producers' reports, at the close of the year; the corresponding figure for 1928 is 72.3 per cent.

Portland cement manufacturing capacity of the United States, 1928 and 1929, by districts

District	Estimated capacity (barrels)		Per cent of capacity utilized	
	1928	1929	1928	1929
Eastern Pennsylvania, New Jersey, and Maryland	50, 945, 000	53, 983, 000	77. 9	69. 9
New York and Maine	17, 037, 000	18, 449, 000	67. 4	61. 9
Ohio, western Pennsylvania, and West Virginia	24, 671, 000	26, 400, 000	74. 3	67. 9
Michigan	19, 508, 000	18, 535, 000	71. 0	74. 2
Wisconsin, Illinois, Indiana, and Kentucky	27, 057, 000	29, 293, 000	84. 1	73. 0
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	24, 667, 000	25, 034, 000	64. 7	55. 1
Eastern Missouri, Iowa, Minnesota, and South Dakota	22, 993, 000	22, 661, 000	72. 6	69. 3
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas[1]	14, 598, 000	17, 136, 000	74. 9	72. 3
Texas	7, 700, 000	9, 950, 000	82. 4	74. 1
Colorado, Montana, Utah, Wyoming,[1] and Idaho[1]	5, 567, 000	6, 669, 000	49. 8	40. 4
California	22, 700, 000	23, 350, 000	59. 7	56. 1
Oregon and Washington	6, 259, 000	7, 457, 000	63. 3	45. 5
	243, 702, 000	258, 917, 000	72. 3	65. 9

[1] Arkansas, Wyoming, and Idaho began producing in 1929.

The following estimates of relation between the production of finished Portland cement and the manufacturing capacity of the industry for each month in 1929 and for the 12 months ending with each month, based on the monthly reports of the producers, indicate the seasonal changes in the utilization of capacity. These estimates include, besides the increases in production and capacity due to improvements at old plants, the production and capacity of the new plants put into operation during the period covered by the estimates. The new plants for 1929 are listed on page 406.

Ratio (per cent) of finished Portland cement produced to manufacturing capacity, 1928 and 1929

	Monthly		12 months ended—			Monthly		12 months ended—	
	1928	1929	1928	1929		1928	1929	1928	1929
January	49. 4	46. 5	74. 5	71. 0	July	87. 0	80. 4	73. 7	68. 9
February	47. 5	44. 8	75. 1	71. 0	August	93. 1	86. 1	73. 5	68. 2
March	51. 7	47. 4	74. 6	70. 9	September	91. 7	81. 8	73. 7	67. 5
April	70. 0	67. 1	74. 0	71. 1	October	87. 1	77. 0	73. 8	67. 3
May	86. 6	76. 4	73. 9	70. 2	November	77. 4	66. 6	74. 1	66. 8
June	90. 1	80. 9	73. 8	69. 0	December	60. 4	51. 5	74. 0	66. 4

The following table gives statistics of capacity by the two general methods—the "wet" and the "dry"—used in the manufacture of Portland cement at the plants in the United States. The figures given are based on the estimated capacity of the wet and dry process plants for the manufacture of finished cement. The figures show that in 1929 the wet-process plants, representing 42.2 per cent of the total manufacturing capacity of the United States, in turning out 43.2 per cent of the finished cement produced in 1929, utilized 67.3 per cent of the wet-process capacity, and that the dry-process plants, accredited with 57.8 per cent of the total manufacturing capacity of the United States, in turning out 56.8 per cent of the finished cement produced in 1929, utilized 64.9 per cent of the dry-process capacity.

In 1928 the wet-process plants representing 39 per cent of the total manufacturing capacity, in turning out 38.1 per cent of the finished cement produced in that year, utilized 70.8 per cent of the wet-process capacity; the dry-process plants, accredited with 61 per cent of the total manufacturing capacity of the United States, in turning out 61.9 per cent of the finished cement produced in 1928, utilized 73.4 per cent of the dry-process capacity. Statistics of production of both clinker and finished cement, by processes, appear on page 410.

Portland cement manufacturing capacity of the United States, 1928 and 1929, by processes

Process	Estimated capacity				Per cent of capacity utilized		Per cent of total finished cement produced	
	Barrels		Per cent of total					
	1928	1929	1928	1929	1928	1929	1928	1929
Wet	94, 979, 000	109, 347, 000	39. 0	42. 2	70. 8	67. 3	38. 1	43. 2
Dry	148, 723, 000	149, 570, 000	61. 0	57. 8	73. 4	64. 9	61. 9	56. 8
	243, 702, 000	258, 917, 000	100. 0	100. 0	72. 3	65. 9	100. 0	100. 0

SPECIAL CEMENTS

In addition to the standard or "ordinary" Portland cement a number of types of cement are now being manufactured and put on the market in increasing quantities in the United States. These have been developed in response to a demand for cement of certain pronounced qualities or characteristics, such as greater plasticity and high-early strength, quick-hardening, and waterproofing qualities for special needs or uses. As stated, such special cements as the white Portland cement and the plastic and waterproofed Portland cement have long been produced and marketed in the United States and have been included in the statistics in Mineral Resources. Alumina cement, a hydraulic cement noted especially for its attainment of high strength at early periods, has been manufactured in the United States for some years.

Among the natural cements that are noted for their plasticity and are much used in masonry, the producers now report "mixed" and "improved" cements.

According to the reports of the producers, 5,121,539 barrels of special cements of the Portland-cement class were manufactured in the United States in 1929, as compared with 2,441,063 barrels in 1928, and 4,935,594 barrels, valued at $8,834,322, were shipped from the mills in 1929, as compared with 2,364,938 barrels, valued at $4,881,024, in 1928. These figures do not include statistics of white Portland cement, as the Bureau of Mines is not at liberty to publish such figures separately. Companies reported the shipment of special cements of their own manufacture from 38 plants in 16 States in 1929, including 2 plants that shipped from stock but did not produce special cements during the year. An additional plant reported production but no shipments. The producers reported the manufacture of special cements at 32 plants in 14 States in 1928. The statistics are shown separately in the following table; they are included in the general statistics for Portland cement throughout this report.

Although a cement classified in one group may have qualities or characteristics by which another group is designated (for example, a high-early strength Portland cement which is also plastic), the grouping in the table follows the name or characteristic reported by the producer.

Special Portland cements reported produced and shipped in the United States, 1928 and 1929, by types[1]

Type	Number of plants reporting		Production (barrels)		Shipments				Average factory value per barrel	
					1928		1929			
	1928	1929	1928	1929	Barrels	Value	Barrels	Value	1928	1929
High-early strength and quick-hardening Portland cement	10	14	1,374,329	3,723,115	1,383,527	$2,488,190	3,545,754	$5,718,813	$1.80	$1.61
Plastic and waterproofed Portland cement[2]	23	33	1,066,734	1,398,424	981,411	2,392,834	1,389,840	3,115,509	2.44	2.24

[1] Classified according to names or characteristics reported by the producers.

[2] Includes so-called "Oil-well," "Plastite," and "Super" Portland cements.

MASONRY, NATURAL, AND PUZZOLAN CEMENTS

The term "masonry cement" is used here to designate certain cements made, like natural cements, by grinding calcined calcareous rock and being used largely in mortar for laying brick and stone, although other hydraulic cements are also suitable for masonry.

Natural cement, including masonry cement, was produced in 1929 in 10 plants, situated as follows: Utica, Ill.; Speed, Ind.; Fort Scott, Kans.; Kosmosdale, Ky.; Austin and Mankato, Minn.; Brixment and Rosendale, N. Y.; Lisbon, Ohio; and Siegfried, Pa. The figures for 1929 include the output of a new plant in New York which began operating toward the end of 1929, superseding an establishment that was active in 1928 but reported idle and out of business in 1929.

One manufacturer with a plant at Birmingham, Ala., reports an output of puzzolan or slag-lime cement, and in order that this output may be included in the cement totals for the United States without disclosure it is included with the statistics of masonry and natural cements.

The next table, which gives figures on the output of masonry, natural, and puzzolan cements from 1925 to 1929, shows a production in 1929 of 2,209,465 barrels, which represents a decrease of 0.04 per cent compared with 1928. Shipments of these cements from mills in 1929 decreased nearly 2.5 per cent in quantity but increased 1.4 per cent in gross value as compared with 1928. Stocks at the mills were more than 36.6 per cent higher at the end of 1929 than at the end of 1928. The average factory value per barrel of the cement shipped from the mills in 1929 was $1.37, as compared with $1.31 in 1928. As with Portland cement, these cements are packed four sacks to the barrel, each sack holding about 1 cubic foot. The lower specific gravity of the non-Portland cements accounts for their lighter weight per barrel, the barrels ordinarily ranging in weight from 240 to 320 pounds. For statistical purposes, the output has been expressed in terms of 376-pound barrels to correspond with the figures for Portland cement.

Approximately 389,000 short tons of limestone ("cement rock") was reported by the producers as entering into the manufacture of masonry and natural cements in the United States in 1929.

Producers reported that 36,474 short tons of coal was consumed in 1929 in the manufacture of these cements; in addition, they reported the use of small quantities of coke and gas having a total fuel value equivalent to approximately 3,521 short tons of coal. The fuel consumption in 1928 amounted to 46,629 short tons of coal; in addition, there were reported consumed small quantities of coke, oil, and gas having a total fuel value equivalent to approximately 645 short tons of coal.

At natural-cement plants in the United States where coal was reported as the only fuel used the average consumption in 1929 was 43 pounds of coal per barrel (376 pounds) of cement, as compared with an average consumption in 1928 of 55 pounds of coal per barrel (376 pounds) of cement.

Masonry, natural, and puzzolan cements produced, shipped, and in stock at mills in the United States, 1925–1929

Year	Production		Shipments		Stock (Dec. 31)
	Active plants	Barrels of 376 pounds	Barrels of 376 pounds	Value	Barrels of 376 pounds
1925	10	1,729,343	1,751,725	$2,551,583	107,459
1926	11	2,104,891	2,031,851	2,820,110	181,928
1927	11	2,123,868	2,158,323	2,881,029	143,854
1928	11	2,210,404	2,213,645	2,910,097	[1] 137,357
1929	11	2,209,465	2,159,130	2,950,717	187,692

[1] Revised figures.

IMPORTS AND EXPORTS[4]

IMPORTS

The quantities given in the following tables include imports of hydraulic cement of all kinds.

The imports of hydraulic cement into the United States in 1929—1,727,900 barrels—show a decrease of 24.4 per cent from 1928, as compared with an increase of 11.4 per cent in 1928 over 1927. The imports, by countries, were approximately as follows: From Belgium, 1,186,000 barrels (nearly 69 per cent of the total imports); Denmark, 320,000 barrels; United Kingdom, 179,000 barrels; Germany, 18,000 barrels; Norway, 10,000 barrels; and other countries, 15,000 barrels. The districts into which more than 200,000 barrels of cement was imported in 1929 are, in order, Los Angeles, New York, Massachusetts, and Porto Rico. The total quantity imported into these four districts was more than 79 per cent of the total imports into the United States in 1929. The average of the values assigned to the imports, which are supposed to represent the values in the foreign countries from which the material is exported, including the cost of the containers or coverings, was $1.12, a decrease of 23 cents per barrel compared with 1928.

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[4] Figures on imports and exports compiled by J. A Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The tariff act of 1922 put hydraulic cements on the free list, with the proviso that if any country imposes a duty on such cement coming from the United States an equal duty shall be imposed upon such cement coming into the United States from that country.

Roman, Portland, and other hydraulic cements imported into the United States, 1928 and 1929, by countries

[General imports]

Country	1928		1929	
	Barrels	Value	Barrels	Value
Belgium	1,726,557	$2,303,635	1,186,166	$1,176,619
Canada	37,821	82,827	5,803	13,253
Denmark	338,724	442,506	319,679	413,805
France	10,276	26,028	7,882	16,261
Germany	9,276	21,612	18,186	33,914
Hungary	10	31	------	------
Irish Free State	3	34	------	------
Italy	5	14	1,180	4,338
Norway	61,327	73,655	10,450	12,196
Poland and Danzig	4,166	3,555	------	------
Sweden	1	8	139	573
United Kingdom	95,919	136,955	178,415	267,281
	2,284,085	3,090,860	1,727,900	1,938,240

Roman, Portland, and other hydraulic cements imported into the United States, 1928 and 1929, by districts

[General imports]

District	1928		1929	
	Barrels	Value	Barrels	Value
Alaska	------	------	48	$218
Connecticut	------	------	3,000	3,094
Duluth-Superior	------	------	9	23
Florida	72,806	$91,548	15,750	17,188
Galveston	105,637	137,691	14,400	21,297
Hawaii	37,444	47,438	100	212
Los Angeles	15,188	28,780	494,618	300,868
Maine and New Hampshire	50,335	98,862	5,740	12,997
Maryland	4,166	3,555	3,489	7,000
Massachusetts	470,340	660,914	280,501	351,131
New Orleans	15,584	20,246	36,473	45,102
New York	222,833	302,259	312,978	430,289
North Carolina	177,160	238,586	38,495	47,879
Ohio	2	12	------	------
Oregon	70,728	87,583	34,461	41,968
Philadelphia	167,522	237,523	71,333	97,200
Porto Rico	324,286	432,954	278,214	391,166
Rhode Island	54,036	71,016	35,750	45,105
Sabine	6,420	13,564	5,500	8,988
St. Lawrence	1,510	2,894	------	------
San Antonio	15,000	17,700	19,432	20,825
San Francisco	380	725	9,091	11,589
South Carolina	413,055	516,084	63,245	77,899
Vermont	974	1,378	6	15
Virginia	1,200	1,328	3,017	3,280
Washington	57,479	78,220	2,250	2,907
	2,284,085	3,090,860	1,727,900	1,938,240

Roman, Portland, and other hydraulic cements imported into the United States in 1929, by countries and districts

[General imports]

Country and district	Barrels	Value
Belgium:		
Connecticut	3,000	$3,094
Florida	15,750	17,188
Galveston	14,400	21,297
Hawaii	100	212
Los Angeles	476,343	266,944
Massachusetts	272,418	341,002
New Orleans	35,972	44,342
New York	73,320	91,363
North Carolina	38,495	47,879
Oregon	34,461	41,968
Philadelphia	55,729	77,905
Porto Rico	40,001	67,701
Rhode Island	35,750	45,105
Sabine	5,500	8,988
San Antonio	19,432	20,825
South Carolina	63,245	77,899
Washington	2,250	2,907
	1,186,166	1,176,619
Canada:		
Alaska	48	218
Duluth and Superior	9	23
Maine and New Hampshire	5,740	12,997
Vermont	6	15
	5,803	13,253
Denmark:		
Los Angeles	100	255
Maryland	3,489	7,000
Massachusetts	6,000	6,300
New York	74,577	80,456
Porto Rico	235,513	319,794
	319,679	413,805
France:		
Massachusetts	2,083	$3,829
New York	5,007	10,442
San Francisco	792	1,990
	7,882	16,261
Germany:		
Los Angeles	17,675	32,860
New York	13	36
San Francisco	498	1,018
	18,186	33,914
Italy: New York	1,180	4,338
Norway:		
Porto Rico	2,700	3,671
San Francisco	7,750	8,525
	10,450	12,196
Sweden:		
New York	88	517
San Francisco	51	56
	139	573
United Kingdom:		
Los Angeles	500	809
New Orleans	501	760
New York	158,793	243,137
Philadelphia	15,604	19,295
Virginia	3,017	3,280
	178,415	267,281
	1,727,900	1,938,240

In addition to the imports shown in the preceding tables, "white nonstaining Portland cement" was recorded as "imported for consumption," as follows: 1928, 16,308 barrels, valued at $44,445; 1929, 25,072 barrels, valued at $54,045. The source of these imports, by countries, is not recorded; the figures are included in those shown in the following table.

Hydraulic cement imported for consumption in the United States, 1920–1929

Year	Barrels	Value
1920	524,604	$1,254,729
1921	122,317	388,842
1922	355,931	692,429
1923	1,767,264	3,145,977
1924	2,023,663	3,139,788
1925	3,667,458	$5,836,482
1926	3,244,223	5,154,926
1927	2,065,730	3,007,103
1928	2,302,475	3,135,558
1929	1,745,345	1,983,974

EXPORTS

In 1929 the hydraulic cement exported to foreign countries and to the Philippine Islands and the Virgin Islands of the United States, most of it Portland cement, increased more than 7 per cent in quantity and nearly 5 per cent in value as compared with 1928. The quantity exported in 1929 was 0.5 per cent of the total shipments of hydraulic cement from mills during the year. The average value at the ports of export was $3.48 a barrel, as compared with $3.56 in 1928.

The destinations of exports were approximately as follows: To South America, 275,000 barrels; Mexico, 174,000 barrels; Central America, 143,000 barrels; Cuba, 102,000 barrels; other West Indies and Bermuda, 67,000 barrels; Canada, 60,000 barrels; and other countries, 64,000 barrels. The export trade varies from year to year but has never reached large proportions; since 1921 it has been well under 2,000,000 barrels. During recent years strong competition from manufacturers in Europe, where labor costs are much lower than in the United States, has restricted the foreign market for American cement.

Hydraulic cement exported from the United States, 1928 and 1929, by countries

Country	1928		1929	
	Barrels	Value	Barrels	Value
North America:				
Canada	39,927	$202,628	60,172	$273,079
Central America—				
British Honduras	54	181	3	30
Costa Rica	2,308	7,561	3,190	8,963
Guatemala	4,168	15,215	3,082	10,911
Honduras	14,404	36,028	37,663	95,717
Nicaragua	3,309	9,803	2,530	8,141
Panama	100,955	298,270	95,266	221,562
Salvador	520	3,161	1,325	7,910
Mexico	77,676	250,371	174,208	531,982
Miquelon, Langley, and St. Pierre Islands	----------	----------	1	8
Newfoundland and Labrador	40	192	535	1,979
West Indies—				
British—				
Barbados	20	132	10	65
Bermuda	1,887	4,268	2,435	5,933
Jamaica	22	153	6	38
Trinidad and Tobago	----------	----------	2,075	6,528
Other British	10,772	27,605	19,418	44,930
Cuba	99,907	256,201	102,257	247,876
Dominican Republic	4,277	17,741	2,926	11,626
French	----------	----------	40	100
Haiti	21,446	46,186	13,247	26,002
Netherland	18,657	48,960	26,467	76,503
Virgin Islands of the United States	301	714	647	1,755
South America:				
Argentina	67,899	393,846	70,264	408,744
Bolivia	4,619	12,570	7,598	22,415
Brazil	24,011	143,105	25,637	136,182
Chile	4,847	24,934	7,907	38,805
Colombia	69,194	176,616	29,325	113,857
Ecuador	2,466	7,452	2,045	6,475
Guiana—				
British	5	36	5	34
French	165	421	495	1,279
Peru	8,376	29,481	6,508	26,277
Uruguay	79,051	226,301	16,519	96,575
Venezuela	81,913	225,370	108,090	269,900
Europe:				
Azores and Madeira Islands	165	485	155	959
Belgium	16	106	427	2,383
Czechoslovakia	----------	----------	100	555
Denmark	161	1,440	167	1,229
Finland	10	65	----------	----------
France	----------	----------	15	97
Germany	3,131	17,780	3,255	17,932
Greece	170	1,003	520	3,142
Hungary	500	2,888	----------	----------
Irish Free State	370	2,070	298	1,718
Italy	150	887	32	165
Netherlands	432	2,627	375	2,229
Norway	370	2,320	895	5,505
Portugal	26	127	190	1,155
Rumania	35	216	----------	----------
Spain	495	2,913	356	2,136
Sweden	56	427	15	100
United Kingdom	45,787	265,032	30,118	168,945

Hydraulic cement exported from the United States, 1928 and 1929, by countries—Continued

Country	1928		1929	
	Barrels	Value	Barrels	Value
Asia:				
Arabia			50	$190
China	1,482	$8,776	1,038	5,856
East Indies—				
British—				
Ceylon	120	774	40	259
India	4,420	27,045	3,861	23,091
Malaya	5,840	33,735	3,990	22,797
Netherland—				
Java and Madura	1,224	5,041	1,105	6,360
Other Netherland	242	2,270	165	1,810
Hong Kong	795	4,704	965	5,699
Iraq	250	1,535	168	1,018
Japan	1,271	9,620	2,837	21,931
Kwantung			1	5
Palestine	755	4,430	1,138	6,679
Persia	1	15	322	12,115
Philippine Islands	926	9,456	197	1,713
Siam	25	162		
Africa:				
British—				
East	120	720	375	2,626
Union of South	631	3,897	943	5,845
West	1	6	125	319
Egypt	313	1,747		
French—Other			375	955
Liberia			3	11
Portuguese—				
Mozambique	125	725	315	1,910
Other Portuguese	70	236	8	21
Oceania:				
British—				
Australia	7,781	40,290	4,427	26,941
New Zealand	2,775	16,494	4,009	24,491
Other British	265	750	40	116
French	160	386	10	28
	824,656	2,938,702	885,321	3,083,217

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, 1928 and 1929

	1928		1929	
	Barrels	Value	Barrels	Value
Alaska	13,838	$41,430	17,906	$54,052
Hawaii	291,305	681,468	289,040	687,904
Porto Rico	46,700	114,409	45,397	105,325
	351,843	837,307	352,343	847,281

Hydraulic cement exported from the United States, 1920–1929

Year	Barrels	Value	Per cent of total shipments from mills	Year	Barrels	Value	Per cent of total shipments from mills
1920	2,985,807	$10,045,369	3.1	1925	1,019,597	$3,003,128	0.6
1921	1,181,014	4,276,986	1.2	1926	974,326	2,995,833	.6
1922	1,127,845	3,206,201	1.0	1927	816,726	2,796,717	.5
1923	1,001,688	2,944,174	.7	1928	824,656	2,938,702	.5
1924	878,543	2,615,154	.6	1929	885,321	3,083,217	.5

CEMENT PRODUCTION IN CANADA

The total mill output of Portland cement in Canada in 1929 was 12,252,203 barrels, according to the Dominion Bureau of Statistics. The shipments amounted to 12,284,081 barrels, valued at $19,337,235, compared with 11,023,928 barrels, valued at $16,739,163, in 1928, an increase of 11.4 per cent in quantity and of 15.5 per cent in value. The average selling price over the whole Dominion, computed from the total quantity sold and the total value as given, was $1.57 per barrel in 1929 and $1.52 per barrel in 1928.

The apparent consumption of cement in Canada in 1929 increased 12.2 per cent over that in 1928. Imports of Portland cement in 1929 amounted to 55,980 barrels, having an average value of $3.38 per barrel, as compared with an average of $4.29 per barrel in 1928. Exports of Portland cement amounted to 234,111 barrels, valued at $252,955. The supply of cement made available for consumption in Canada in 1929 was the greatest on record—12,105,950 barrels.

Summary statistics of the cement industry in Canada, 1928 and 1929 [1]

	1928		1929	
	Barrels	Value	Barrels	Value
Output	11,076,659		12,252,203	
Sold or used	11,023,928	$16,739,163	12,284,081	$19,337,235
Stocks, Dec. 31	1,520,583		1,488,751	
Imports:				
Portland	34,047	146,164	55,980	189,169
Manufactures		31,594		64,942
Exports	267,325	340,624	234,111	252,955
Apparent consumption	10,790,650		12,105,950	

[1] Dominion Bureau of Statistics.

Cement is produced in the Provinces of Quebec, Ontario, Manitoba, Alberta, and British Columbia. Eleven plants were represented in the output in 1928 and 1929. In 1929 mills in Quebec produced 42.1 per cent of the total Canadian shipments; in Ontario, 37.7 per cent; in Manitoba, 8.1 per cent; in Alberta, 6.6 per cent; and in British Columbia, 5.5 per cent. Fifty-seven rotary kilns were in operation during the year with a total rated capacity of 44,022 barrels per day.

The average selling price per barrel, by Provinces, in 1929, computed from the quantity sold and the value as given was as follows: Quebec, $1.38; Ontario, $1.43; Manitoba, $2.35; Alberta, $2.19; and British Columbia, $2.18.

The following table shows sales from mills in 1928 and 1929, by Provinces:

Cement sold by Canadian mills, 1928 and 1929, by Provinces[1]

Province	1928		1929	
	Barrels	Value	Barrels	Value
Quebec	4,913,820	$6,305,396	5,169,408	$7,120,374
Ontario	3,911,795	5,520,897	4,624,712	6,608,246
Manitoba	693,450	1,685,084	1,000,258	2,350,606
Alberta	834,067	1,732,582	808,796	1,770,786
British Columbia	670,796	1,495,204	680,907	1,487,223
Canada	11,023,928	16,739,163	12,284,081	19,337,235

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[1] Dominion Bureau of Statistics.

PETROLEUM[1]

By G. R. Hopkins and A. B. Coons[2]

SUMMARY

The production of crude petroleum in the United States during 1929 amounted to 1,007,323,000 barrels, a new high record and an increase of 105,849,000 barrels, or 12 per cent, over 1928. The year 1929 was the first billion-barrel year for the United States.

In addition to the output of crude petroleum, 52,271,000 barrels of natural gasoline and 3,055,000 barrels of benzol were produced and 108,710,000 barrels of crude and refined oils were imported, making a total new supply of 1,171,359,000 barrels. Stocks of all oils increased 68,156,000 barrels during the year, compared with an increase of 22,775,000 barrels in 1928. Exports of all oils amounted to 163,120,000 barrels in 1929, which, when deducted from total demand, gives an indicated domestic demand for all oils of 940,083,000 barrels, an increase of 9 per cent over 1928. (See fig. 11, p. 426.)

The production of crude petroleum increased rapidly up to August, the peak month, when the daily average nearly reached the 3,000,000-barrel mark. (See fig. 9.) A material factor in this gain in output was the incentive supplied by a price increase in May. Production tapered off in the last four months of the year, when consumption was also declining.

Texas, with an output of 296,876,000 barrels in 1929, was again the leading producing State, although it was followed closely by California, which, with a production of 292,534,000 barrels, rose from third to second place. Oklahoma dropped from second to third place, although its output of 255,004,000 barrels represented a small increase over 1928. These three States accounted for 84 per cent of the total output in 1929, compared with 82 per cent in 1928.

The major part of the new production obtained in Texas in 1929 came from west Texas, from extensions and deeper drilling in the Gulf coast area, from Gray County (Panhandle), and from the Bruner field of Caldwell and Guadalupe Counties. The most important factors in the increased output in California were the rapid development of the deep sands at Santa Fe Springs and the unusual success attending drilling at Elwood. Drilling in the Oklahoma City pool in Oklahoma did not really get under way until 1930, but the field produced nearly 9,000,000 barrels in 1929, compared with only about 100,000 barrels in 1928; new discoveries in and around the Seminole area more than made up for the decline of the older wells of the district. (See fig. 10.)

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[1] Work on manuscript completed December, 1930.

[2] Unless otherwise indicated, the tables in this report were prepared by Misses A. B. Coons, M. N. Schellenger, and A. L. Clapp and Mrs. C. S. Evans, of the Bureau of Mines. Figures on imports and exports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

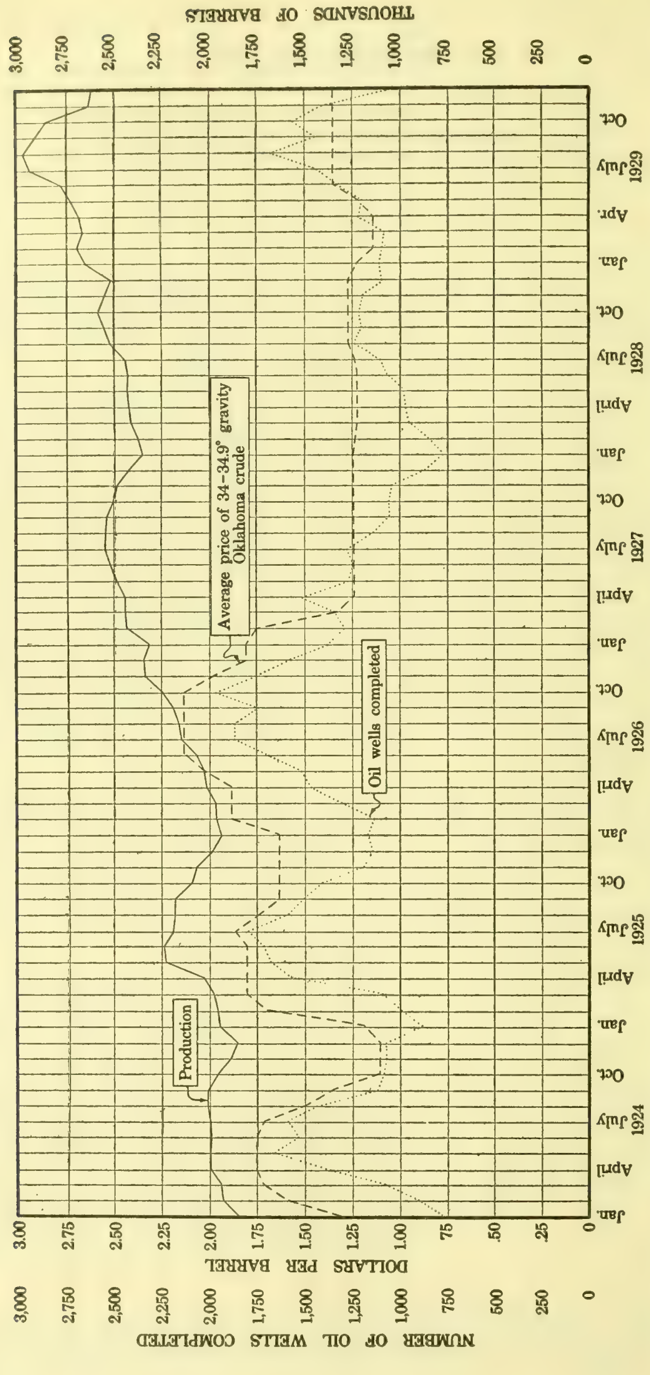

FIGURE 9.—Daily average production of crude petroleum in the United States, total number of oil wells completed, and average price of a selected grade of Oklahoma crude, 1924-1929, by months

The world production of crude petroleum during 1929 reached a total of 1,485,829,000 barrels, an increase of 161,096,000 barrels, or 12.2 per cent, over 1928. Production outside the United States reached a total of 478,506,000 barrels, or 55,247,000 barrels more than in 1928, whereas domestic production increased 105,849,000 barrels. The rate of increase in domestic production did not quite equal that in the foreign oil-producing countries; consequently, the ratio of the United States' production to that of the world dropped from 68 per cent in 1928 to 67.8 per cent in 1929.

Total crude stocks east of California, including producers' stocks, increased from 374,874,000 barrels at the beginning of the year to 387,396,000 barrels on December 31, 1929. Nearly half of this increase of roughly 12,500,000 barrels occurred in refinery stocks. In California the increase in crude output progressed even faster than in the remainder of the country, and stocks of crude, including fuel oil, were increased by more than 36,000,000 barrels.

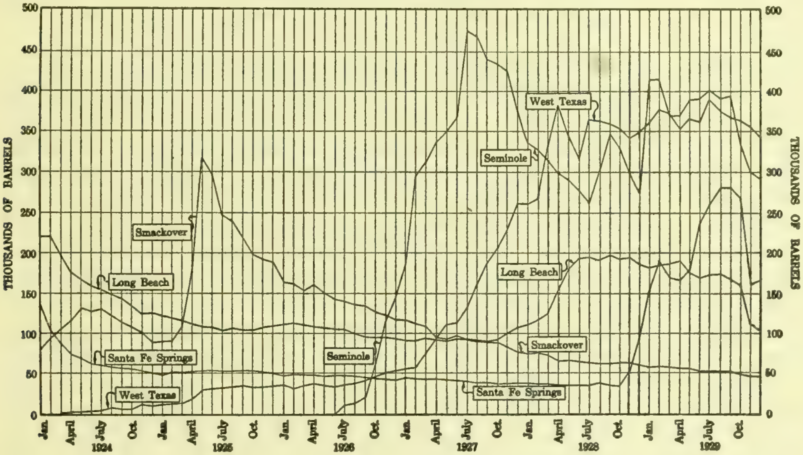

FIGURE 10.—Daily average production of crude petroleum in flush fields, 1924–1929, by months

Imports of crude petroleum, which had increased materially during 1928, did not quite hold their own in 1929. The total quantity brought in during 1929 amounted to 78,933,000 barrels, compared with 79,767,000 barrels in 1928. Imports of crude oil from Mexico were lower in 1929, for the seventh successive year, whereas those from Venezuela were again higher although the increase in 1929 was much smaller than in previous years. Imports of crude petroleum from Colombia showed a small increase in 1929, but those from "other countries" remained of little importance. Shipments of California crude oil through the Panama Canal to eastern ports in the United States continued to decline and amounted to only 1,299,000 barrels in 1929, compared with 2,301,000 barrels in 1928.

Drilling activity, after falling off for two successive years, increased decidedly in 1929. Oil wells completed increased from 12,526 in 1928 to 15,572 in 1929; gas wells, from 2,727 to 2,870; and dry holes, from 7,078 to 7,914. August was the peak month for drilling, with 2,662 wells completed. (See fig. 17.)

On December 31, 1929, there were 328,200 producing oil wells in the United States, compared with 327,800 oil wells producing at the beginning of the year. As more than 15,000 oil wells were completed during 1929, the increase of only 400 in total number of oil wells producing indicates that there was almost a balance between new wells brought in and wells abandoned. Texas, California, and Oklahoma, which had nearly all the flush production in 1929, together had a net loss in number of wells in 1929, whereas New York, Pennsylvania, and West Virginia, with average yields per well per day of less than a barrel, all gained in number of wells during the same period. The average yield per well per day rose from 7.6 barrels in 1928 to 8.4 barrels in 1929, an increase due primarily to the striking of gushers in the two leading States, Texas and California. The lowest average yields reported in 1929 were in the Lima district of northwestern Ohio and northeastern Indiana, where an average of only 0.2 barrel per well per day was produced. The highest average daily yield—161.3 barrels—was credited to west Texas fields; this is, however, considerably below the average of 208.9 barrels achieved in 1928. (See fig.10.)

The total value of the crude petroleum produced in 1929 amounted to $1,280,417,000, the highest total recorded since 1926; the average value was $1.27 per barrel in 1929 compared with $1.17 in 1928. This increase in average value was somewhat unexpected, considering the material increase in production, and resulted primarily from higher prices paid for crude in Texas, exclusive of the Gulf coast, and in California. The crude produced in these two areas in 1929 (more than half of the total output) rose 19 and 11 cents, respectively, in average value. A comparison of the average values, as submitted by the purchasers, with the record of posted prices shows that the posted price increase of May 20 to 22 was largely responsible for the gain in values. This increase in posted price was fairly general throughout the country east of California and more than made up for the price decreases posted late in January. Except for Alaska, where the scarcity of crude attaches an unusually high value to the small quantity produced, only two States, Michigan and New Mexico, had a lower average value in 1929 than in 1928. The average price paid by New York purchasers—$3.90 per barrel—was the highest in any State; that in west Texas—$0.83—was the lowest.

Data on supply and demand of all oils follow. (See also fig. 11.)

Summary of statistics relating to supply and demand of all oils, 1918–1929

	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928[1]	1929
Domestic production:												
Crude petroleum.......thousands of barrels[2]..	355, 928	378, 367	442, 929	472, 183	557, 531	732, 407	713, 940	763, 743	770, 874	901, 129	901, 474	1, 007, 323
Natural gasoline....do....	6, 727	8, 370	9, 161	10, 713	12, 044	19, 434	22, 235	26, 307	32, 305	38, 657	42, 326	52, 271
Benzol....do....	1, 273	1, 497	1, 771	1, 348	1, 688	2, 327	2, 203	1, 857	2, 112	2, 562	2, 809	3, 055
Total....do....	363, 928	388, 234	453, 861	484, 244	571, 263	754, 168	738, 378	791, 907	805, 291	942, 348	946, 609	1, 062, 649
Imports:												
Crude petroleum....do....	37, 736	52, 822	106, 175	125, 364	127, 308	82, 015	77, 775	61, 824	60, 382	58, 383	79, 767	78, 933
Refined products....do....	1, 227	1, 376	2, 647	3, 428	8, 665	17, 638	16, 806	16, 376	20, 938	13, 353	11, 790	29, 777
Total new supply, all oils....do....	402, 891	442, 432	562, 683	613, 036	707, 236	853, 821	832, 959	870, 107	886, 611	1, 014, 084	1, 038, 166	1, 171, 359
Increase in stocks, all oils....do....	[3]24, 518	4, 053	27, 303	84, 583	102, 024	99, 461	27, 897	29, 291	[3]26, 419	70, 092	22, 775	68, 156
Exports:[4]												
Crude petroleum....do....	5, 884	6, 348	9, 295	9, 627	10, 805	17, 534	18, 239	13, 337	15, 407	15, 844	18, 966	26, 401
Refined products....do....	62, 128	57, 500	70, 281	62, 025	63, 539	84, 447	98, 905	100, 497	116, 543	125, 805	135, 991	136, 719
Domestic demand, all oils....do....	359, 397	374, 531	455, 804	456, 801	530, 868	652, 379	687, 918	726, 982	781, 080	802, 343	860, 434	940, 083
Crude runs to stills....do....	326, 025	361, 520	433, 915	443, 363	500, 706	581, 238	643, 719	739, 920	779, 264	828, 835	913, 295	987, 708
World production of crude petroleum....do....	503, 515	555, 875	688, 884	766, 002	858, 898	1, 015, 736	1, 014, 318	1, 068, 933	1, 096, 823	1, 262, 582	1, 324, 733	1, 486, 208
United States percentage of world production of crude petroleum....	71	68	64	62	65	72	70	71	70	71	68	68
Total value of domestic production of crude petroleum at wells....thousands of dollars..	703, 944	760, 266	1, 360, 745	814, 745	895, 111	978, 430	1, 022, 683	1, 284, 960	1, 447, 760	1, 172, 830	1, 054, 880	1, 280, 417
Average price per barrel of crude petroleum at wells.	$1.98	$2.01	$3.07	$1.73	$1.61	$1.34	$1.43	$1.68	$1.88	$1.30	$1.17	$1.27
Total number of producing oil wells in the United States, Dec. 31....	([5])	([5])	[6]258, 600	274, 500	284, 880	290, 100	299, 100	306, 100	318, 600	323, 300	327, 800	328, 200
Total number of oil wells completed in the United States during year....	17, 845	21, 052	24, 273	14, 666	17, 333	16, 206	14, 587	16, 559	19, 013	14, 442	12, 526	15, 572

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[1] Some of the entries for 1928 are revised figures.
[2] 42 United States gallons.
[3] Decrease.
[4] Includes shipments to noncontiguous Territories.
[5] Figures not available.
[6] Oct. 31.

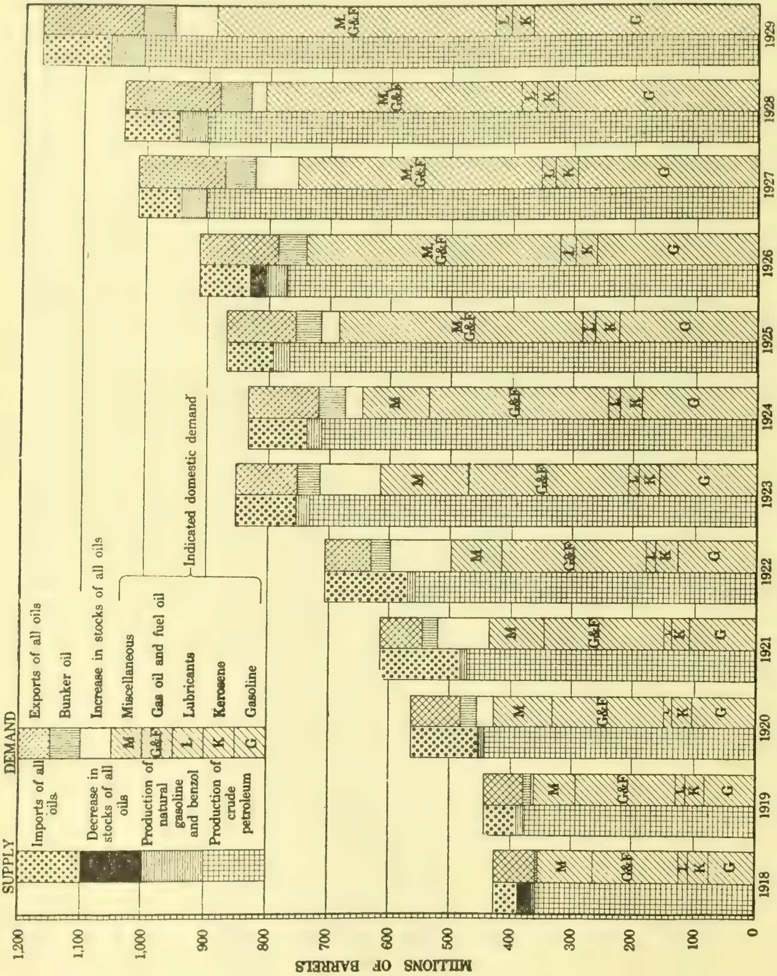

FIGURE 11.—Supply and demand of all oils, 1918-1929

Summary of supply and demand of all oils (including wax, coke, and asphalt), 1928 and 1929, by months

[Thousands of barrels of 42 U. S. gallons]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1928[1]													
New supply:													
Domestic production—													
Crude petroleum	72,793	68,565	74,528	72,393	75,277	72,676	75,584	77,807	76,484	79,751	76,123	79,493	901,474
Daily average	2,348	2,364	2,404	2,413	2,428	2,423	2,438	2,510	2,549	2,573	2,537	2,564	2,463
Natural gasoline	3,414	3,326	3,474	3,464	3,493	3,364	3,436	3,438	3,488	3,731	3,769	3,929	42,326
Benzol	226	216	239	229	238	231	229	233	231	245	240	252	2,809
Total production	76,433	72,107	78,241	76,086	79,008	76,271	79,249	81,478	80,203	83,727	80,132	83,674	946,609
Daily average	2,466	2,486	2,524	2,536	2,549	2,542	2,556	2,628	2,673	2,701	2,671	2,699	2,586
Imports[2]—													
Crude petroleum	6,330	6,036	6,845	5,661	6,766	6,553	7,878	6,141	7,139	6,703	6,908	6,807	79,767
Refined products	1,165	1,055	1,134	1,680	1,162	712	782	1,007	598	771	728	996	11,790
Total new supply, all oils	83,928	79,198	86,220	83,427	86,936	83,536	87,909	88,626	87,940	91,201	87,768	91,477	1,038,166
Daily average	2,707	2,731	2,781	2,781	2,804	2,785	2,836	2,859	2,931	2,942	2,926	2,951	2,837
Increase in stocks, all oils	10,446	6,875	5,918	2,986	411	[3]883	[3]3,689	[3]2,891	[3]2,409	35	1,149	4,827	22,775
Demand:													
Total demand	73,482	72,323	80,302	80,441	86,525	84,419	91,598	91,517	90,349	91,166	86,619	86,650	1,015,391
Daily average	2,370	2,494	2,590	2,681	2,791	2,814	2,955	2,952	3,012	2,941	2,887	2,795	2,774
Exports[2]—													
Crude petroleum	1,225	1,243	1,530	1,303	1,493	1,879	1,669	1,883	1,506	2,015	1,691	1,529	18,966
Refined products	11,748	9,638	11,309	11,833	13,100	12,287	12,760	10,874	11,360	10,279	11,331	9,472	135,991
Domestic demand	60,509	61,442	67,463	67,305	71,932	70,253	77,169	78,760	77,483	78,872	73,597	75,649	860,434
Daily average	1,952	2,119	2,176	2,243	2,320	2,342	2,489	2,541	2,583	2,544	2,453	2,440	2,351
Excess of daily average domestic production over domestic demand	514	367	348	293	229	200	67	87	90	157	218	259	235
Stocks (end of month):													
Crude petroleum[4]	481,712	486,199	490,818	492,419	492,473	491,938	490,298	488,934	486,930	488,349	488,193	490,788 [5]491,847	490,788 [5]491,847
Natural gasoline at plants	740	824	843	831	810	648	476	414	436	402	405	607	607
Refined products	125,170	127,474	128,754	130,151	130,529	130,343	128,466	127,001	126,574	125,224	126,526	128.556	128,556
Grand total stocks, all oils	607,622	614,497	620,415	623,401	623,812	622,929	619,240	616,349	613,940	613,975	615,124	619,951 [5]621,010	619,951 [5]621,010
Days' supply[6]	256	246	240	233	224	221	210	209	204	209	213	222	223
Bunker oil (included above in domestic demand)	3,930	3,751	4,226	4,275	5,013	4,307	4,116	4,564	4,053	4,558	4,235	4,188	51,226

[1] Some of the entries for 1928 are revised figures.

[2] From Bureau of Foreign and Domestic Commerce. Exports include benzol and shipments to Alaska, Hawaii, and Porto Rico.

[3] Decrease.

[4] Includes fuel oil in California.

[5] For comparison with 1929.

[6] Grand total stocks of all oils, divided by daily average total demand.

Summary of supply and demand of all oils (including wax, coke, and asphalt), 1928 and 1929, by months—Continued

[Thousands of barrels of 42 U. S. gallons]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1929													
New supply:													
Domestic production—													
Crude petroleum	82, 054	75, 456	82, 463	80, 412	84, 499	83, 407	91, 309	92, 165	87, 453	88, 430	78, 758	80, 917	1, 007, 323
Daily average	2, 647	2, 695	2, 660	2, 680	2, 726	2, 780	2, 945	2, 973	2, 915	2, 853	2, 625	2, 610	2, 760
Natural gasoline	3, 983	3, 736	4, 324	4, 264	4, 343	4, 250	4, 417	4, 507	4, 574	4, 912	4, 504	4, 457	52, 271
Benzol	250	233	264	255	267	257	264	264	253	265	245	238	3, 055
Total production	86, 287	79, 425	87, 051	84, 931	89, 109	87, 914	95, 990	96, 936	92, 280	93, 607	83, 507	85, 612	1, 062, 649
Daily average	2, 783	2, 837	2, 808	2, 831	2, 874	2, 930	3, 096	3, 127	3, 076	3, 020	2, 784	2, 762	2, 911
Imports [2]—													
Crude petroleum	8, 075	7, 016	6, 790	7, 828	7, 552	6, 591	6, 122	5, 800	6, 953	5, 766	4, 554	5, 886	78, 933
Refined products	884	908	1, 489	2, 634	2, 732	2, 426	3, 176	3, 430	2, 725	3, 643	3, 327	2, 403	29, 777
Total new supply, all oils	95, 246	87, 349	95, 330	95, 393	99, 393	96, 931	105, 288	106, 166	101, 958	103, 016	91, 388	93, 901	1, 171, 359
Daily average	3, 072	3, 120	3, 075	3, 180	3, 206	3, 231	3, 396	3, 425	3, 399	3, 323	3, 046	3, 029	3, 209
Increase in stocks, all oils	10, 682	10, 223	11, 085	5, 963	3, 605	6, 248	4, 985	4, 872	5, 498	4, 579	[3] 3, 042	3, 458	68, 156
Demand:													
Total demand	84, 564	77, 126	84, 245	89, 430	95, 788	90, 683	100, 303	101, 294	96, 460	98, 437	94, 430	90, 443	1, 103, 203
Daily average	2, 728	2, 755	2, 718	2, 981	3, 090	3, 023	3, 236	3, 268	3, 215	3, 175	3, 148	2, 918	3, 022
Exports [2]—													
Crude petroleum	1, 972	1, 678	1, 600	1, 726	1, 932	2, 615	3, 117	2, 236	1, 988	2, 869	2, 579	2, 089	26, 401
Refined products	11, 760	9, 507	10, 873	10, 364	11, 080	12, 483	12, 441	12, 771	8, 570	13, 984	10, 565	12, 321	136, 719
Domestic demand	70, 832	65, 941	71, 772	77, 340	82, 776	75, 585	84, 745	86, 287	85, 902	81, 584	81, 286	76, 033	940, 083
Daily average	2, 285	2, 355	2, 315	2, 578	2, 670	2, 520	2, 734	2, 783	2, 863	2, 632	2, 710	2, 453	2, 576
Excess of daily average domestic production over domestic demand	498	482	493	253	204	410	362	344	213	388	74	309	335
Stocks (end of month):													
Crude petroleum [4]	497, 525	505, 920	512, 989	516, 161	518, 980	523, 104	529, 983	538, 982	543, 557	545, 186	539, 837	540, 851	540, 851
Natural gasoline at plants	741	821	995	1, 166	1, 390	1, 356	1, 156	893	661	490	514	604	604
Refined products	133, 426	135, 174	139, 016	141, 636	142, 198	144, 356	142, 662	138, 798	139, 953	143, 074	145, 357	147, 711	147, 711
Grand total stocks, all oils	631, 692	641, 915	653, 000	658, 963	662, 568	668, 816	673, 801	678, 673	684, 171	688, 750	685, 708	689, 166	689, 166
Days' supply [6]	232	233	240	221	214	221	208	208	213	217	218	236	228
Bunker oil (included above in domestic demand)	3, 915	4, 252	4, 183	4, 179	4, 704	4, 544	4, 593	4, 734	4, 424	4, 540	4, 110	4, 100	52, 278

[2] From Bureau of Foreign and Domestic Commerce. Exports include benzol and shipments to Alaska, Hawaii, and Porto Rico.
[3] Decrease.
[4] Includes fuel oil in California.
[6] Grand total stocks of all oils, divided by daily average total demand.

PRODUCTION

DOMESTIC PRODUCTION

BY MONTHS

The production of crude petroleum increased rapidly up to August, the peak month, when the daily average nearly reached the 3,000,000-barrel mark. A material factor in this gain was the incentive supplied by a price increase in May. Production tapered off in the last four months of the year, but by that time consumption was also on the down grade.

Petroleum produced in the United States, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	January	February	March	April	May	June	July	August	September	October	November	December	The year
1925	60, 400	54, 775	61, 339	62, 048	68, 850	67, 240	67, 763	67, 580	65, 432	64, 842	61, 927	61, 547	763, 743
1926	59, 981	54, 892	60, 880	60, 371	62, 822	61, 789	65, 168	67, 009	65, 782	69, 664	69, 891	72, 625	770, 874
1927	71, 758	68, 122	75, 514	73, 132	76, 845	75, 303	78, 780	78, 788	75, 909	77, 534	74, 493	74, 951	901, 129
1928	72, 793	68, 565	74, 528	72, 393	75, 277	72, 676	75, 584	77, 807	76, 484	79, 751	76, 123	79, 493	901, 474
1929	82, 054	75, 456	82, 463	80, 412	84, 499	83, 407	91, 309	92, 165	87, 453	88, 430	78, 758	80, 917	1, 007, 323

BY FIELDS OR DISTRICTS

The Mid-Continent district continued in 1929 to be the major producing area in the United States, although the ratio of its production to the total declined from 61 per cent in 1928 to 58 per cent in 1929. Production in the Appalachian district increased in 1929 for the fifth successive year; that in the Lima-Northeastern Indiana and Illinois-Southwestern Indiana districts declined in 1929 for the nineteenth successive year. The territory east of the Mississippi River produced only 4.7 per cent of the total output in 1929, compared with 35.8 per cent in 1909.

According to the Pennsylvania Grade Crude Oil Association, the production of Pennsylvania-grade crude oil, which includes practically all of the output of New York, Pennsylvania, and West Virginia and about half of the output of central and eastern Ohio, amounted to 23,425,000 barrels in 1929, an increase of 2,328,000 barrels, or 11 per cent, over 1928. Slightly more than half of the 1929 total was produced in Pennsylvania.

Pennsylvania-grade crude oil produced, 1924–1929, by States [1]

[Thousands of barrels of 42 U. S. gallons]

State	1924	1925	1926	1927	1928	1929
New York	1, 440	1, 695	1, 956	2, 242	2, 603	3, 377
Pennsylvania	7, 486	8, 097	8, 961	9, 526	9, 956	11, 820
West Virginia	5, 920	5, 763	5, 946	6, 023	5, 661	5, 574
Central and eastern Ohio	2, 168	2, 242	2, 011	2, 346	2, 877	2, 654
	17, 014	17, 797	18, 874	20, 137	21, 097	23, 425

[1] Pennsylvania Grade Crude Oil Association.

Petroleum produced in the United States, 1928 and 1929, by fields

[Thousands of barrels of 42 U. S. gallons]

Field	January	February	March	April	May	June	July	August	September	October	November	December	The year		
													Quantity	Value at wells	
														Total (thousands of dollars)	Average per barrel
1928															
Appalachian	2,402	2,414	2,647	2,512	2,764	2,568	2,667	2,722	2,472	2,776	2,552	2,563	31,059	82,320	$2.65
Lima-Indiana	124	131	145	137	163	157	159	145	129	141	116	123	1,670	2,630	1.57
Michigan	31	30	29	37	46	50	56	46	37	73	88	71	594	920	1.55
Illinois and southwestern Indiana	580	591	706	543	654	628	632	659	588	646	595	603	7,425	11,450	1.54
Mid-Continent	44,560	41,825	45,624	44,901	45,719	43,610	45,707	48,005	[1] 48,080	[1] 50,097	[1] 46,688	[1] 48,211	[1] 553,027	[1] 634,430	1.15
Gulf coast [2]	3,717	3,322	3,725	3,632	4,075	4,033	4,155	4,150	[1] 3,851	[1] 4,051	[1] 3,876	[1] 4,102	[1] 46,689	[1] 55,270	1.18
Rocky Mountain [3]	2,410	2,186	2,570	2,339	2,548	2,435	2,471	2,581	2,422	2,586	2,352	2,299	29,199	37,860	1.30
California [4]	18,969	18,066	19,082	18,292	19,308	19,195	19,737	19,499	18,905	19,381	19,856	21,521	231,811	230,000	.99
	72,793	68,565	74,528	72,393	75,277	72,676	75,584	77,807	76,484	79,751	76,123	79,493	901,474	1,054,880	1.17
Daily average	2,348	2,364	2,404	2,413	2,428	2,423	2,438	2,510	2,549	2,573	2,537	2,564	2,463		
1929															
Appalachian	2,589	2,349	2,649	2,713	2,901	2,668	3,021	2,913	2,852	3,199	2,936	3,034	33,824	104,490	3.09
Lima-Indiana	108	99	128	125	134	152	164	153	125	134	115	110	1,547	2,660	1.72
Michigan	158	129	144	162	236	483	699	627	499	522	460	409	4,528	6,140	1.36
Illinois and southwestern Indiana	591	536	680	533	630	588	633	647	603	644	584	568	7,237	11,950	1.65
Mid-Continent	48,614	44,100	47,824	46,582	49,510	48,097	52,900	53,176	50,021	49,158	45,714	47,362	583,058	728,190	1.25
Gulf coast [2]	4,384	3,925	4,436	4,793	4,704	4,455	4,652	4,896	4,783	5,411	5,301	5,366	57,106	69,080	1.21
Rocky Mountain [3]	2,157	1,947	2,209	2,137	2,262	2,272	2,426	2,503	2,446	2,458	2,314	2,358	27,489	36,540	1.33
California [4]	23,453	22,371	24,393	23,367	24,122	24,692	26,814	27,250	26,124	26,904	21,334	21,710	292,534	321,367	1.10
	82,054	75,456	82,463	80,412	84,499	83,407	91,309	92,165	87,453	88,430	78,758	80,917	1,007,323	1,280,417	1.27
Daily average	2,647	2,695	2,660	2,680	2,726	2,780	2,945	2,973	2,915	2,853	2,625	2,610	2,760		

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[1] Revised figures.
[2] Salt-dome pools.
[3] Includes Alaska.
[4] Annual and semiannual figures from Division of Mines, Department of Natural Resources, California. Monthly figures prorated on basis of monthly reports by the American Petroleum Institute.

BY STATES

Texas, with an output of 296,876,000 barrels in 1929, was again the leading producing State, although it was followed closely by California which, with a production of 292,534,000 barrels, rose from third to second place. Oklahoma dropped from second to third place, although its output of 255,004,000 barrels represented a small increase over 1928. (See fig. 12.) These three States accounted for 84 per cent of the total output in 1929, compared with 82 per cent in 1928. Other changes in rank among the producing States were as follows: Michigan rose from eighteenth to thirteenth place; Montana fell from thirteenth to fourteenth; Colorado, from fourteenth to sixteenth; and Indiana, from sixteenth to eighteenth.

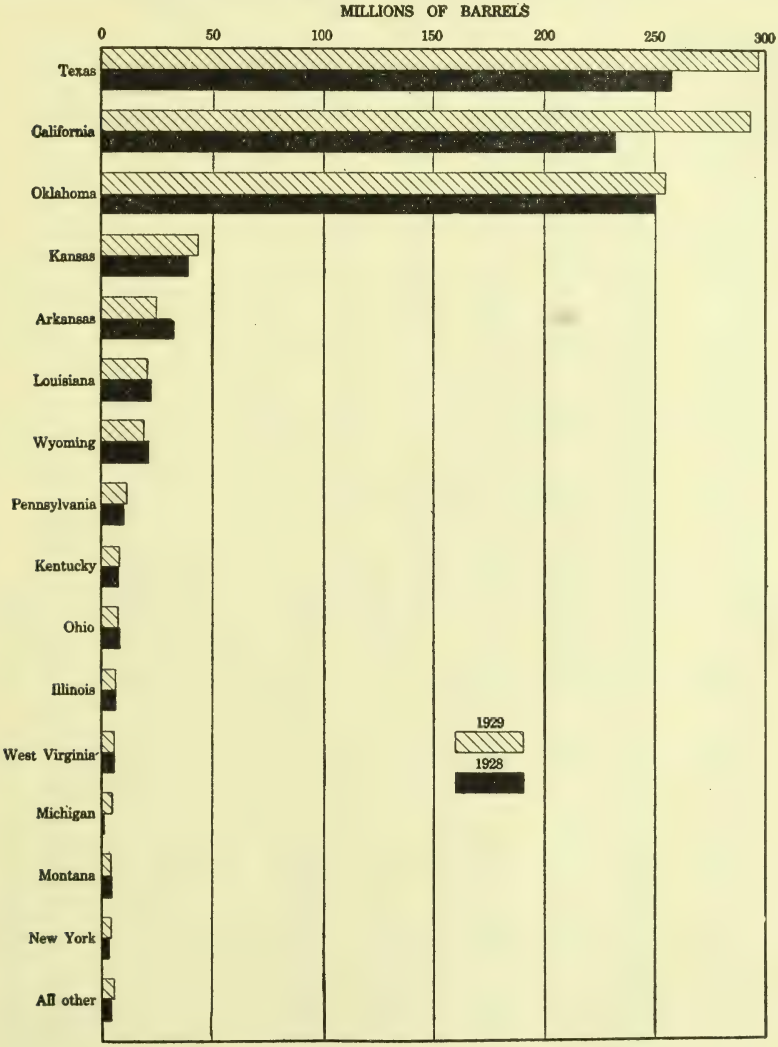

FIGURE 12.—Production of crude petroleum, 1928 and 1929, by States

Petroleum produced in the United

[Thousands of barrels

Year	New York	Pennsylvania	Ohio	West Virginia	California	Kentucky	Tennessee	Colorado	Indiana	Illinois	Kansas
1859-1875	(2)	[2]74,072	-------	-------	-------	-------	-------	-------	-------	-------	-------
1876	(2)	[2]8,969	32	120	12	-------	-------	-------	-------	-------	-------
1877	(2)	[2]13,135	30	172	13	-------	-------	-------	-------	-------	-------
1878	(2)	[2]15,164	38	180	15	-------	-------	-------	-------	-------	-------
1879	(2)	[2]19,685	29	180	20	-------	-------	-------	-------	-------	-------
1880	(2)	[2]26,028	39	179	40	-------	-------	-------	-------	-------	-------
1881	(2)	[2]27,376	34	151	100	-------	-------	-------	-------	-------	-------
1882	6,685	23,368	40	128	129	-------	-------	-------	-------	-------	-------
1883	4,004	19,125	47	126	143	[3]5	(3)	-------	-------	-------	-------
1884	3,231	20,541	90	90	262	[3]4	(3)	-------	-------	-------	-------
1885	2,658	18,118	662	91	325	[3]5	(3)	-------	-------	-------	-------
1886	2,151	23,647	1,783	102	377	[3]5	(3)	-------	-------	-------	-------
1887	2,075	20,281	5,023	145	678	[3]5	(3)	76	-------	-------	-------
1888	(2)	[2]16,489	10,011	119	690	[3]5	(3)	298	-------	-------	-------
1889	1,897	19,591	12,472	544	303	[3]5	(3)	317	33	1	1
1890	(2)	[2]28,458	16,125	493	307	[3]6	(3)	369	64	1	1
1891	1,585	31,424	17,740	2,406	324	[3]9	(3)	666	137	1	1
1892	1,273	27,149	16,363	3,810	385	[3]7	(3)	824	698	1	5
1893	1,032	19,283	16,249	8,446	470	[3]3	(3)	594	2,335	1	18
1894	942	18,078	16,792	8,577	706	[3]2	(3)	516	3,689	(4)	40
1895	913	18,231	19,545	8,120	1,209	[3]2	(3)	438	4,386	(4)	44
1896	1,205	19,379	23,941	10,020	1,253	[3]2	(3)	361	4,681	(4)	114
1897	1,279	17,983	21,561	13,090	1,903	(3 4)	(3)	385	4,122	1	81
1898	1,205	14,743	18,739	13,615	2,257	[3]6	(3)	444	3,731	(4)	72
1899	1,321	13,054	21,142	13,911	2,642	[3]18	(3)	390	3,848	(4)	70
1900	1,301	13,258	22,363	16,196	4,325	[3]62	(3)	317	4,874	(4)	75
1901	1,207	12,625	21,648	14,177	8,787	[3]137	(3)	461	5,757	(4)	179
1902	1,120	12,064	21,014	13,513	13,984	[3]185	(3)	397	7,481	(4)	332
1903	1,163	11,355	20,480	12,900	24,382	[3]554	(3)	484	9,186	-------	932
1904	1,113	11,126	18,877	12,645	29,649	[3]998	(3)	501	11,339	-------	4,251
1905	1,118	10,437	16,347	11,578	33,428	[3]1,217	(3)	376	10,964	181	[6]12,014
1906	1,243	10,257	14,788	10,121	33,099	[3]1,214	(3)	328	7,674	4.397	[6]21,718
1907	1,212	10,000	12,207	9,095	39,748	[3]821	(3)	332	5,128	24,282	2,410
1908	1,160	9,424	10,859	9,523	44,855	728	-------	380	3,283	33,686	1,801
1909	1,135	9,299	10,633	10,745	55,472	639	-------	311	2,296	30,898	1,264
1910	1,054	8,795	9,916	11,753	73,011	469	-------	240	2,160	33,143	1,128
1911	953	8,248	8,817	9,796	81,134	472	-------	227	1,695	31,317	1,279
1912	874	7,838	8,969	12,129	87,269	484	-------	206	970	28,602	1,593
1913	948	7,917	8,781	11,567	97,788	525	-------	189	956	23,894	2,375
1914	939	8,170	8,536	9,680	99,775	503	-------	223	1,336	21,920	3,104
1915	888	7,838	7,825	9,265	86,592	437	-------	208	876	19,042	2,823
1916	874	7,593	7,744	8,731	90,952	1,202	1	197	769	17,714	8,738
1917	880	7,733	7,751	8,379	93,878	3,088	12	121	760	15,777	36,536
1918	809	7,408	7,285	7,867	97,532	4,368	8	143	878	13,366	45,451
1919	851	8,137	7,736	8,327	101 183	9,278	15	121	972	11,960	33,048
1920	906	7,438	7,400	8,249	103,377	8,738	14	111	945	10,774	39,005
1921	988	7,418	7,335	7,822	112,600	9,013	12	108	1,158	10,043	36,456
1922	1,000	7,425	6,781	7,021	138,468	8,973	10	97	1,087	9,383	31,766
1923	1,250	7,609	7,085	6,358	262,876	8,069	8	86	1,043	8,707	28,250
1924	1,440	7,486	6,811	5,920	228,933	7,407	10	445	935	8,081	28,836
1925	1,695	8,097	7,212	5,763	232,492	6,759	24	1,226	829	7,863	38,357
1926	1,956	8,961	7,272	5,946	224,673	6,274	43	2,768	808	7,760	41,498
1927	2,242	9,526	7,593	6,023	231,196	6,719	60	2,831	852	6,994	41,069
1928	2,603	9,956	7,015	5,661	231,811	7,359	46	2,774	1,052	6,462	38,596
1929	3,377	11,820	6,743	5,574	292,534	7,775	19	2,358	981	6,319	42,813
	[7]71,755	[7]828,629	542,350	367,139	3,270,366	[8]104,556	[8]282	24,244	116,768	392,571	[6]548,144
Percentage of total production	0.6	6.8	4.4	3.0	26.7	0.8	-----	0.2	1.0	3.2	4.5

[1] 1889-1899, Missouri; 1900-1906, Michigan and Missouri; 1907-1911, Michigan, Missouri, and Utah; 1912, 1917, 1918, Alaska and Michigan; 1913 and 1919, Alaska, Michigan, Missouri, and New Mexico; 1914-1916, Alaska, Michigan, and Missouri; 1920, Alaska, Arkansas, Missouri, New Mexico, and Utah; 1921-1923, Alaska, Missouri, and New Mexico; 1924-1929, Alaska and Utah.

[2] New York included with Pennsylvania.

[3] Tennessee included with Kentucky, 1883 to 1907, inclusive.

States, 1859–1929, by States

of 42 U. S. gallons]

Texas	Oklahoma	Wyoming	Michigan	Louisiana	New Mexico	Montana	Arkansas	Other[1]	Total		
									Quantity	Value at wells	
										Total (thousands of dollars)	Average per barrel
-------	-------	-------	-------	-------	-------	-------	-------	-------	74,072	215,781	$2.91
-------	-------	-------	-------	-------	-------	-------	-------	-------	9,133	22,983	2.52
-------	-------	-------	-------	-------	-------	-------	-------	-------	13,350	31,789	2.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	15,397	18,045	1.17
-------	-------	-------	-------	-------	-------	-------	-------	-------	19,914	17,211	.86
-------	-------	-------	-------	-------	-------	-------	-------	-------	26,286	24,601	.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	27,661	25,448	.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	30,350	23,631	.78
-------	-------	-------	-------	-------	-------	-------	-------	-------	23,450	25,790	1.10
-------	-------	-------	-------	-------	-------	-------	-------	-------	24,218	20,596	.85
-------	-------	-------	-------	-------	-------	-------	-------	-------	21,859	19,198	.88
-------	-------	-------	-------	-------	-------	-------	-------	-------	28,065	19,996	.71
-------	-------	-------	-------	-------	-------	-------	-------	-------	28,283	18,877	.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	27,612	17,948	.65
(4)	-------	-------	-------	-------	-------	-------	-------	(4)	35,164	26,963	.77
(4)	-------	-------	-------	-------	-------	-------	-------	(4)	45,824	35,365	.77
(4)	(4)	-------	-------	-------	-------	-------	-------	(4)	54,293	30,527	.56
(4)	(4)	-------	-------	-------	-------	-------	-------	(4)	50,515	25,907	.51
(4)	(4)	-------	-------	-------	-------	-------	-------	(4)	48,431	28,950	.60
(4)	(4)	2	-------	-------	-------	-------	-------	(4)	49,344	35,522	.72
(4)	(4)	4	-------	-------	-------	-------	-------	(4)	52,892	57,632	1.09
1	(4)	3	-------	-------	-------	-------	-------	(4)	60,960	58,519	.96
66	1	4	-------	-------	-------	-------	-------	(4)	60,476	40,874	.68
546	-------	6	-------	-------	-------	-------	-------	(4)	55,364	44,193	.80
669	-------	6	-------	-------	-------	-------	-------	(4)	57,071	64,604	1.13
836	6	6	(5)	-------	-------	-------	-------	2	63,621	75,989	1.19
4,394	10	5	(5)	-------	-------	-------	-------	2	69,389	66,417	.96
18,084	37	6	(5)	549	-------	-------	-------	1	88,767	71,179	.80
17,956	139	9	(5)	918	-------	-------	-------	3	100,461	94,694	.94
22,241	1,367	12	(5)	2,959	-------	-------	-------	3	117,081	101,175	.86
28,136	(6)	8	(5)	8,910	-------	-------	-------	3	134,717	84,157	.62
12,568	(6)	7	(5)	9,077	-------	-------	-------	3	126,494	92,445	.73
12,323	43,524	9	(5)	5,000	-------	-------	-------	4	166,095	120,107	.72
11,207	45,799	18	(5)	5,789	-------	-------	-------	15	178,527	129,079	.72
9,534	47,859	20	(5)	3,060	-------	-------	-------	6	183,171	128,329	.70
8,899	52,029	115	(5)	6,841	-------	-------	-------	4	209,557	127,900	.61
9,526	56,069	187	(5)	10,721	-------	-------	-------	8	220,449	134,045	.61
11,735	51,427	1,572	(5)	9,263	-------	-------	-------	4	222,935	164,213	.74
15,010	63,579	2,407	(5)	12,499	(5)	-------	-------	11	248,446	237,121	.95
20,068	73,632	3,560	(5)	14,309	-------	-------	-------	8	265,763	214,125	.81
24,943	97,915	4,246	(5)	18,192	-------	-------	-------	14	281,104	179,463	.64
27,645	107,072	6,234	(5)	15,248	-------	45	-------	8	300,767	330,900	1.10
32,413	107,508	8,978	(5)	11,392	-------	100	-------	10	335,316	522,635	1.56
38,750	103,347	12,596	(5)	16,043	-------	69	-------	8	355,928	703,944	1.98
79,366	86,911	13,172	(5)	17,188	(5)	90	-------	12	378,367	760,266	2.01
96,868	106,206	16,831	-------	35,714	(5)	340	(5)	13	442,929	1,360,745	3.07
106,166	114,634	19,333	-------	27,103	(5)	1,509	10,473	12	472,183	814,745	1.73
118,684	149,571	26,715	-------	35,376	(5)	2,449	12,712	13	557,531	895,111	1.61
131,023	160,929	44,785	-------	24,919	(5)	2,782	36,610	18	732,407	978,430	1.34
134,522	173,538	39,498	-------	21,124	98	2,815	46,028	13	713,940	1,022,683	1.43
144,648	176,768	29,173	4	20,272	1,060	4,091	77,398	12	763,743	1,284,960	1.68
166,916	179,195	25.776	94	23,201	1,666	7,727	58,332	8	770,874	1,447,760	1.88
217,389	277,775	21,307	439	22,818	1,226	5,058	40,005	7	901,129	1,172,830	1.30
257,320	249,857	21,461	594	21,847	943	4,015	32,096	6	901,474	1,054,880	1.17
296,876	255,004	19,314	4,528	20,554	1,830	3,980	24,917	7	1,007,323	1,280,417	1.27
2,077,328	[6] 2,781,708	317,385	[8] 5,659	420,886	[9] 6,823	35,070	338,571	238	12,250,472	16,601,694	-------
17.0	22.7	2.6	-------	3.4	-------	0.3	2.8	-------	100.0	-------	-------

[4] Less than 500 barrels. (See Mineral Resources, 1916, pt. 2, pp. 684-685.)
[5] Included under "Other."
[6] Oklahoma included with Kansas in 1905 and 1906.
[7] Early production in New York included with Pennsylvania.
[8] Figures represent 1925-1929 production only. Earlier years included under "Other."
[9] Figures represent 1924-1929 production only. Earlier years included under "Other."

Petroleum produced in the United States, 1928 and 1929, by States

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year	Value at wells (thousands of dollars)
1928														
Arkansas	2,716	2,569	2,699	2,396	2,826	3,070	2,791	2,682	2,556	2,647	2,601	2,543	32,096	27,450
California[1]	18,969	18,066	19,082	18,292	19,308	19,195	19,737	19,499	18,905	19,381	19,856	21,521	231,811	230,000
Colorado	224	232	264	224	226	229	252	245	212	232	221	213	2,774	2,750
Illinois	510	516	635	468	573	550	551	573	506	558	508	514	6,462	9,980
Indiana:														
Southwestern	70	75	71	75	81	78	81	86	82	88	87	89	963	1,470
Northeastern	7	8	7	8	9	8	7	8	7	8	6	6	89	110
Total Indiana	77	83	78	83	90	86	88	94	89	96	93	95	1,052	1,580
Kansas	3,362	3,248	3,561	3,422	3,444	3,274	3,283	3,222	2,912	3,073	2,828	2,967	38,596	52,500
Kentucky	542	558	623	618	653	563	681	662	594	660	608	597	7,359	11,850
Louisiana:														
Gulf coast[2]	434	431	477	439	487	774	797	796	644	575	580	619	7,053	8,150
Northern	1,374	1,265	1,302	1,307	1,343	1,221	1,219	1,222	1,135	1,172	1,137	1,097	14,794	17,700
Total Louisiana	1,808	1,696	1,779	1,746	1,830	1,995	2,016	2,018	1,779	1,747	1,717	1,716	21,847	25,850
Michigan	31	30	29	37	46	50	56	46	37	73	88	71	594	920
Montana	378	350	358	321	347	309	295	347	336	308	316	350	4,015	6,400
New Mexico	78	65	75	71	72	63	88	83	65	88	89	106	943	1,280
New York	185	181	195	192	211	225	200	230	219	249	251	265	2,603	8,750
Ohio:														
Central and eastern	445	441	480	455	492	471	462	473	416	466	418	415	5,434	11,950
Northwestern	117	123	138	129	154	149	152	137	122	133	110	117	1,581	2,520
Total Ohio	562	564	618	584	646	620	614	610	538	599	528	532	7,015	14,470
Oklahoma	21,040	19,166	19,980	18,921	19,745	19,009	19,175	21,363	22,796	23,862	22,040	22,760	249,857	347,600
Pennsylvania	768	770	842	792	884	836	838	860	795	893	828	850	9,956	32,550
Tennessee	2	4	5	4	5	2	5	8	4	2	3	2	46	70
Texas:														
Gulf coast[2]	3,283	2,891	3,248	3,193	3,588	3,259	3,358	3,354	[3]3,207	[3]3,476	[3]3,296	[3]3,483	[3]39,636	[3]47,120
West Texas	8,119	8,272	10,279	11,426	10,735	9,487	11,284	11,210	10,760	10,924	10,245	10,799	123,540	80,520
Rest of State	7,949	7,305	7,803	7,429	7,626	7,549	7,955	8,306	[3]7,921	[3]8,419	[3]7,837	[3]8,045	[3]94,144	[3]108,660
Total Texas	19,351	18,468	21,330	22,048	21,949	20,295	22,597	22,870	21,888	22,819	21,378	22,327	257,320	236,300

West Virginia	460	460	502	451	519	471	481	489	444	506	444	434	5,661	17,150
Wyoming	1,730	1,539	1,873	1,722	1,902	1,833	1,835	1,905	1,808	1,958	1,726	1,630	21,461	27,400
Other [4]	----------	----------	----------	1	1	1	1	1	1	----------	----------	----------	6	30
United States	72,793	68,565	74,528	72,393	75,277	72,676	75,584	77,807	76,484	79,751	76,123	79,493	901,474	1,054,880
Daily average	2,348	2,364	2,404	2,413	2,428	2,423	2,438	2,510	2,549	2,573	2,537	2,564	2,463	----------
Classified by gravity (approximately):														
Light	64,209	60,365	65,812	64,964	67,691	65,131	67,746	69,959	69,043	71,581	67,901	71,132	805,534	1,054,880
Heavy	8,584	8,200	8,716	7,429	7,586	7,545	7,838	7,848	7,441	8,170	8,222	8,361	95,940	
United States	72,793	68,565	74,528	72,393	75,277	72,676	75,584	77,807	76,484	79,751	76,123	79,493	901,474	1,054,880
1929														
Arkansas	2,354	2,114	2,331	2,231	2,205	2,033	2,078	2,048	1,946	1,930	1,794	1,853	24,917	21,890
California [1]	23,453	22,371	24,393	23,367	24,122	24,692	26,814	27,250	26,124	26,904	21,334	21,710	292,534	321,367
Colorado	217	188	208	191	224	219	220	196	189	176	157	173	2,358	2,380
Illinois	508	455	603	457	552	517	561	572	532	566	506	490	6,319	10,430
Indiana:														
Southwestern	83	81	77	76	78	71	72	75	71	78	78	78	918	1,520
Northeastern	4	4	6	6	6	7	5	5	5	5	5	5	63	90
Total Indiana	87	85	83	82	84	78	77	80	76	83	83	83	981	1,610
Kansas	2,939	2,717	3,093	3,385	3,812	3,795	4,323	4,194	3,963	3,681	3,427	3,484	42,813	62,510
Kentucky	585	511	560	584	636	547	710	676	722	810	724	710	7,775	13,220
Louisiana:														
Gulf coast [2]	752	564	609	609	576	584	599	596	635	706	626	598	7,454	9,150
Northern	1,056	973	1,082	1,051	1,066	1,045	1,100	1,076	1,142	1,190	1,126	1,193	13,100	16,550
Total Louisiana	1,808	1,537	1,691	1,660	1,642	1,629	1,699	1,672	1,777	1,896	1,752	1,791	20,554	25,700
Michigan	158	129	144	162	236	483	699	627	499	522	460	409	4,528	6,140
Montana	312	264	340	340	362	351	360	357	340	339	314	301	3,980	7,260
New Mexico	76	67	92	79	96	87	152	164	235	260	257	265	1,830	2,170
New York	262	240	267	277	295	284	301	285	282	288	281	315	3,377	13,170
Ohio:														
Central and eastern	431	388	442	441	456	431	489	430	422	468	423	438	5,259	13,200
Northwestern	104	95	122	119	128	145	159	148	120	129	110	105	1,484	2,570
Total Ohio	535	483	564	560	584	576	648	578	542	597	533	543	6,743	15,770

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[1] Annual and semiannual figures from Division of Mines, Department of Natural Resources, California. Monthly figures prorated on basis of monthly reports by the American Petroleum Institute.

[2] Salt-dome pools.

[3] Revised figures.

[4] Alaska and Utah.

Petroleum produced in the United States, 1928 and 1929, by States—Continued

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year	Value at wells (thousands of dollars)
1929														
Oklahoma	22,856	20,235	21,213	20,689	21,803	20,802	22,874	22,805	21,505	20,739	19,249	20,234	255,004	364,650
Pennsylvania	851	805	913	943	1,020	953	1,037	1,043	972	1,120	1,053	1,110	11,820	44,800
Tennessee	2	2	1	3	2	1	2	2	1	2	1		19	30
Texas:														
Gulf coast[2]	3,632	3,361	3,827	4,184	4,128	3,871	4,053	4,300	4,148	4,705	4,675	4,768	49,652	59,930
West Texas	11,173	10,548	11,518	10,559	11,362	10,868	12,041	11,635	11,014	11,264	10,703	10,643	133,328	110,780
Rest of State	8,236	7,513	8,587	8,667	9,262	9,554	10,484	11,418	10,451	10,354	9,415	9,955	113,896	151,810
Total Texas	23,041	21,422	23,932	23,410	24,752	24,293	26,578	27,353	25,613	26,323	24,793	25,366	296,876	322,520
West Virginia	458	403	466	465	492	452	482	477	453	511	454	461	5,574	20,070
Wyoming	1,552	1,428	1,569	1,526	1,579	1,614	1,693	1,785	1,681	1,682	1,586	1,619	19,314	24,700
Other[4]				1	1	1	1	1	1	1			7	30
United States	82,054	75,456	82,463	80,412	84,499	83,407	91,309	92,165	87,453	88,430	78,758	80,917	1,007,323	1,280,417
Daily average	2,647	2,695	2,660	2,680	2,726	2,780	2,945	2,973	2,915	2,853	2,625	2,610	2,760	
Classified by gravity (approximately):														
Light	73,196	67,664	73,785	72,092	76,237	75,536	83,019	83,494	79,117	79,440	70,005	71,855	905,440	1,280,417
Heavy	8,858	7,792	8,678	8,320	8,262	7,871	8,290	8,671	8,336	8,990	8,753	9,062	101,883	
United States	82,054	75,456	82,463	80,412	84,499	83,407	91,309	92,165	87,453	88,430	78,758	80,917	1,007,323	1,280,417

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[2] Salt-dome pools.

[4] Alaska and Utah.

Daily average production of crude petroleum in the United States, 1928 and 1929, by months and principal States

[Barrels of 42 U. S. gallons]

State	January	February	March	April	May	June	July	August	September	October	November	December	The year
1928													
Arkansas	87,600	88,600	87,100	79,900	91,200	102,300	90,000	86,500	85,200	85,400	86,700	82,000	87,700
California	611,900	623,000	615,500	609,700	622,800	639,800	636,700	629,000	630,200	625,200	661,900	694,200	633,300
Kansas	108,500	112,000	114,900	114,100	111,100	109,200	105,900	103,900	97,000	99,100	94,200	95,700	105,400
Louisiana	58,300	58,500	57,400	58,200	59,000	66,500	65,000	65,100	59,300	56,400	57,200	55,400	59,700
Oklahoma	678,700	660,900	644,500	630,700	637,000	633.600	618,600	689,100	759,900	769,700	734,700	734,200	682,700
Texas	624,200	636,800	688,100	734,900	708,000	676,500	728.900	737,800	729,600	736,100	712,600	720,200	703,100
Wyoming	55,800	53,000	60,400	57,400	61,400	61,100	59,200	61,500	60,300	63,200	57,500	52,600	58,600
All others	123,200	131,500	136,200	128,200	137,800	133,500	133,900	137,000	128,000	137,500	132,600	130,000	132,500
	2,348,200	2,364,300	2,404,100	2,413,100	2,428,300	2,422,500	2,438,200	2,509,900	2,549.500	2,572,600	2,537,400	2,564,300	2,463,000
1929													
Arkansas	75,900	75,500	75,200	74,400	71,100	67,700	67,000	66,100	64,900	62,300	59,800	59,800	68,300
California	756.500	799,000	786,900	778,900	778,100	823,100	865,000	879,000	870,800	867,900	711,100	700,300	801,500
Kansas	94.800	97,000	99,800	112.800	123,000	126,500	139,400	135,300	132,100	118,700	114,200	112,400	117.300
Louisiana	58,300	54,900	54,500	55,300	53,000	54,300	54,800	53,900	59,200	61,100	58,400	57,800	56,300
Oklahoma	737,300	722,700	684,300	689,600	703,300	693,400	737,900	735,600	716,800	669,000	641,600	652,700	698,600
Texas	743,300	765,100	772,000	780,300	798,500	809,800	857,400	882,400	853,800	849,100	826,400	818,200	813,400
Wyoming	50,100	51,000	50,600	50,900	50,900	53,800	54,600	57,600	56,000	54,300	52,900	52,200	52,900
All others	130,700	129,700	136,800	138,200	147,900	151,600	169,400	163,200	161,500	170,200	160,800	156,800	151,500
	2,646,900	2,694,900	2,660,100	2,680,400	2,725,800	2,780.200	2,945,500	2,973,100	2.915,100	2,852,600	2,625,200	2,610,200	2,759,800

Arkansas.—No discoveries of importance were made in Arkansas in 1929, and the production of the State continued to decline. The total output in 1929 amounted to 24,917,000 barrels, compared with 32,096,000 barrels in 1928. Every producing field of any consequence in the State reported a decrease in production in 1929. Attempts to locate deeper horizons in the Smackover field met with little success, but some new production was obtained by reworking old wells and perforating the casing in contact with the shallower sands. The Mount Holly field of Ouachita County was discovered in the spring and looked promising for a time but on the whole was a disappointment.

Because of the decline in output, there was a brisk demand for crude by Arkansas refineries, and stocks declined materially during the year.

Petroleum produced in Arkansas, 1921–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Bradley	Champagnolle	El Dorado	Irma	Lisbon	Smackover	Stephens	Total
1921			10,473					10,473
1922			10,592			2,107	13	12,712
1923			5,830	(1)		30,048	[1]732	36,610
1924			4,760	450		40,000	818	46,028
1925			4,247	334		72,144	673	77,398
1926	52		2,722	763	2,125	52,063	607	58,332
1927	44	(2)	[2]2,433	774	1,054	35,201	499	40,005
1928	31	3,522	2,456	536	566	24,569	416	32,096
1929	24	2,651	1,987	409	492	18,991	363	24,917

[1] Irma included with Stephens.

[2] Champagnolle included with El Dorado.

Petroleum produced in Arkansas, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Bradley	3	3	3	1	2	1	3	3	2	3	4	3	31		31
Champagnolle	10	21	12	71	400	763	449	357	369	365	352	351	3,520	2	3,522
El Dorado	199	187	220	210	210	202	215	219	210	210	189	189	2,460	−4	2,456
Irma	89	64	79	32	39	43	42	28	27	30	34	27	534	2	536
Lisbon	57	51	55	49	49	45	45	44	39	38	36	49	557	9	566
Smackover	2,339	2,225	2,310	2,015	2,108	2,000	2,022	2,013	1,895	1,988	1,969	1,910	24,794	−225	24,569
Stephens	37	35	38	36	36	34	33	37	32	32	35	33	418	−2	416
	2,734	2,586	2,717	2,414	2,844	3,088	2,809	2,701	2,574	2,666	2,619	2,562	32,314	−218	32,096
1929															
Bradley	2	2	1	4	2	1	1	2	2	3	2	2	24		24
Champagnolle	312	257	286	267	245	210	208	195	168	164	157	173	2,642	9	2,651
El Dorado	176	164	184	175	179	159	172	170	160	156	149	138	1,982	5	1,987
Irma	30	33	35	42	40	33	38	46	30	20	41	48	436	−27	409
Lisbon	45	40	43	40	39	42	42	42	41	41	37	38	490	2	492
Smackover	1,763	1,595	1,756	1,679	1,674	1,565	1,590	1,569	1,519	1,523	1,388	1,430	19,051	−60	18,991
Stephens	32	28	32	30	32	29	34	31	32	29	26	30	365	−2	363
	2,360	2,119	2,337	2,237	2,211	2,039	2,085	2,055	1,952	1,936	1,800	1,859	24,990	−73	24,917

California—Production in California established a new record in 1929, when a total of 292,534,000 barrels was produced. This output represents an increase of more than 60,000,000 barrels over 1928 and is nearly 30,000,000 barrels above the output in 1923, the previous high mark.

The major part of the increase in production in California in 1929 resulted from the rapid development of deep zones in the Santa Fe Springs field. This field was partly responsible for the overproduction in 1923, but after that year the output declined so rapidly that in 1928 the production was only slightly more than 16,000,000 barrels. In the latter part of 1928 two deep sands—the Buckbee and Nordstrum—were discovered, and in 1929 three more were found—the O'Connell, Clark, and Hathaway. The Hathaway zone was uncovered too late in the year to have any appreciable effect upon the total output, but the other discoveries were almost feverishly developed, with the result that the total output of the field was more than four and a half times that in 1928. The peak at Santa Fe Springs in 1929, approximately 300,000 barrels daily, was reached in July. Production remained well above the 250,000-barrel mark until late in October, when a material price cut and a rapid decline in gas pressure brought the daily average to below 200,000 barrels.

The second most important producing field in California in 1929 was Long Beach. Although no important extensions were discovered at Long Beach in 1929, the active exploitation of the deep zones maintained production at a high level and the total output for the year, 60,496,000 barrels, was only slightly below the 1928 figure.

Although the discovery well in the Kettleman Hills field was brought in as early as October, 1928, only one other well was placed on production before the end of 1929. This very conservative development was due principally to the great depth of the producing sands, 7,000 to 8,000 feet, and to the restriction placed on drilling through the operation of a mutual agreement between the operators and the Interior Department. The total production of the field in 1929 amounted to 1,952,000 barrels, compared with 200,000 barrels in 1928.

The third most important producing field in California in 1929 was Midway-Sunset. The output of this field amounted to 25,311,000 barrels, compared with 27,314,000 barrels in 1928. The Maricopa Flats section of this field was actively developed in 1929, and the total output of the field would undoubtedly have exceeded the 1928 figure if a large number of the wells had not been shut in.

Other fields recording a material gain in output in 1929 were Elwood, Mount Poso, Seal Beach, and Ventura Avenue. The Elwood field, even though prorated, produced 9,436,000 barrels in 1929, compared with 895,000 barrels in 1928. The producing horizons in this field were found to extend under the Pacific Ocean, and a number of wells were drilled from piers extending some distance offshore.

Several fields in California, which looked promising when discovered, proved disappointing when developed. Outstanding among these was Lawndale, north of the Torrance field. Of the 63 wells drilled at Lawndale in 1929 only 6 were productive.

Wildcatting was active in California in 1929, particularly in the Los Angeles Basin and along the coast line from a point west of the city of Los Angeles to San Luis Obispo. As indicated by developments in 1930, only one of the fields discovered was important—the Playa del Rey field on the coast near Venice.

The increase in crude production in California in 1929 far exceeded the gain in consumption, and stocks increased materially. This condition resulted in a price cut in the middle of January. Prices then remained steady until late in October, when the price of certain grades was temporarily reduced. The rapid increase in the production of light oil from the basin fields caused the closing in of many heavy-oil wells in the San Joaquin Valley, and the total shut-in production was increased accordingly.

Petroleum produced in California, 1928 and 1929, by districts and months [1]

[Thousands of barrels of 42 U. S. gallons]

District	January	February	March	April	May	June	July	August	September	October	November	December	The year
1928													
Coalinga	607	567	602	324	325	319	326	329	314	326	305	311	4,655
Coyote	433	401	424	407	422	403	417	419	389	406	392	389	4,902
Dominguez	402	368	390	380	388	366	359	342	320	320	310	322	4,267
Elk Hills	746	707	729	709	724	707	670	669	632	631	587	596	8,107
Elwood-Goleta	9	9	6	5	3	2	13	72	76	76	252	372	895
Fruitvale							11	9	10	30	32	41	133
Fullerton	465	496	485	484	507	471	457	453	512	487	471	455	5,743
Huntington Beach	1,817	1,681	1,756	1,632	1,677	1,603	1,640	1,605	1,567	1,591	1,538	1,535	19,642
Inglewood	968	890	933	893	911	906	929	931	851	868	833	850	10,763
Kern River	777	788	801	293	213	200	190	188	175	345	544	557	5,071
Kettleman Hills										5	79	116	200
Lawndale												16	16
Long Beach	3,506	3,436	3,877	4,611	5,619	5,831	6,078	5,918	5,940	5,987	5,870	5,794	62,467
Los Angeles-Salt Lake	47	47	48	48	46	47	48	46	45	48	46	45	561
Lost Hills-Belridge	129	128	127	122	126	124	133	126	121	126	130	135	1,527
McKittrick	148	141	153	151	157	147	150	159	148	151	146	155	1,806
Midway-Sunset	2,471	2,338	2,506	2,193	2,189	2,125	2,228	2,287	2,186	2,277	2,247	2,267	27,314
Montebello	396	378	386	375	376	364	368	370	346	344	326	341	4,370
Mount Poso	3	3	1	1	1	4	12	8	9	5	2	5	54
Potrero				2	17	15	13	12	10	9	8	21	107
Richfield	655	579	600	584	587	573	573	555	511	528	514	540	6,799
Rincon	14	12	32	58	90	122	111	111	124	148	135	126	1,083
Rosecrans	245	217	209	197	194	197	190	181	183	183	180	216	2,392
Round Mountain	1	3	4	3	4	13	2	4	3	3	1	3	44
Santa Fe Springs	1,200	1,099	1,165	1,107	1,145	1,116	1,137	1,227	1,121	1,115	1,641	3,021	16,094
Santa Maria	191	189	200	186	178	163	162	154	150	159	157	153	2,042
Seal Beach	1,288	1,188	1,243	1,166	1,121	1,105	1,047	898	787	836	875	882	12,436
Summerland	4	3	4	4	4	4	4	4	3	4	3	4	45
Torrance	611	567	590	562	550	527	561	535	496	502	471	482	6,454
Ventura Avenue	1,617	1,547	1,588	1,534	1,495	1,459	1,663	1,574	1,629	1,682	1,561	1,572	18,921
Ventura-Newhall	195	176	176	171	179	168	179	177	171	156	173	175	2,096
Wheeler Ridge	29	28	28	26	30	28	29	28	27	27	25	25	330
Whittier	52	50	53	51	52	52	51	49	49	53	49	51	612
Other	2	2	2	2	2	3	4	5	3	3	5	2	35
	19,028	18,038	19,118	18,281	19,332	19,164	19,755	19,445	18,908	19,431	19,908	21,575	231,983
Division of Mines, Department of Natural Resources, California [2]	18,969	18,066	19,082	18,292	19,308	19,195	19,737	19,499	18,905	19,381	19,856	21,521	231,811

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[1] Monthly figures by districts from American Petroleum Institute.

[2] Monthly figures prorated from annual and semiannual totals.

Petroleum produced in California, 1928 and 1929, by districts and months—Continued[1]

[Thousands of barrels of 42 U. S. gallons]

District	January	February	March	April	May	June	July	August	September	October	November	December	The year
1929													
Coalinga	300	283	310	298	289	280	325	310	287	293	290	294	3, 559
Coyote	385	352	378	343	347	318	371	354	331	325	327	345	4, 176
Dominguez	318	304	340	322	312	292	313	291	249	263	280	323	3, 607
Elk Hills	591	526	572	556	536	455	487	541	523	535	517	514	6, 353
Elwood-Goleta	517	605	800	858	877	793	840	674	619	911	957	985	9, 436
Fruitvale	27	20	11	7	30	50	65	60	57	73	100	95	595
Fullerton	441	372	416	396	389	375	401	384	384	420	401	435	4, 814
Huntington Beach	1, 489	1, 315	1, 430	1, 342	1, 343	1, 263	1, 361	1, 354	1, 279	1, 294	1, 249	1, 288	16, 007
Inglewood	834	731	791	742	734	678	755	729	685	712	684	693	8, 768
Kern River	560	496	486	482	432	435	483	476	505	571	617	546	6, 089
Kettleman Hills	124	97	107	114	105	99	107	125	186	313	284	291	1, 952
Lawndale	25	20	25	23	49	52	46	44	27	31	27	24	393
Long Beach	5, 635	5, 163	5, 816	5, 703	5, 431	5, 071	5, 387	5, 426	5, 096	5, 046	3, 468	3, 254	60, 496
Los Angeles-Salt Lake	46	42	44	45	48	47	47	48	45	46	48	47	553
Lost Hills-Belridge	135	126	138	133	136	132	140	126	129	134	129	144	1, 602
McKittrick	154	140	151	146	132	129	141	144	136	144	142	149	1, 708
Midway-Sunset	2, 245	1, 979	2, 211	2, 107	2, 038	1, 938	2, 045	2, 059	2, 041	2, 194	2, 170	2, 284	25, 311
Montebello	341	312	341	326	317	286	300	304	282	290	277	282	3, 658
Mount Poso	3	3	1	2	[3]103	145	140	163	215	342	357	352	1, 826
Potrero	24	17	22	21	17	22	22	19	25	33	25	24	271
Richfield	561	488	523	479	489	457	489	472	452	469	440	457	5, 776
Rincon	111	91	109	97	110	103	97	97	90	88	98	101	1, 192
Rosecrans	222	192	212	192	180	181	203	217	220	230	194	221	2, 464
Round Mountain	1	1	2	1	3	1	1	[3]23	34	33	45	79	224
Santa Fe Springs	4, 760	5, 300	5, 275	4, 750	5, 630	7, 124	8, 134	8, 727	8, 427	8, 319	4, 838	5, 193	76, 477
Santa Maria	152	145	146	145	134	119	131	133	118	94	102	117	1, 536
Seal Beach	988	975	1, 295	1, 340	1, 315	1, 400	1, 558	1, 360	1, 189	1, 147	917	934	14, 418
Summerland	4	3	4	3	4	4	4	12	13	16	13	14	94
Torrance	461	424	445	435	422	384	419	414	392	417	396	391	5, 000
Ventura Avenue	1, 679	1, 553	1, 678	1, 661	1, 881	1, 778	1, 758	1, 923	1, 849	1, 889	1, 707	1, 578	20, 934
Ventura-Newhall	176	157	169	155	150	146	153	152	149	148	149	153	1, 857
Wheeler Ridge	24	22	23	22	20	19	20	20	20	21	19	20	250
Whittier	49	44	50	46	45	46	49	48	46	48	46	47	564
Other	4	3	4	3	5	3	5	4	4	6	4	32	77
	23, 386	22, 301	24, 325	23, 295	24, 053	24, 625	26, 797	27, 233	26, 104	26, 895	21, 317	21, 706	292, 037
Division of Mines, Department of Natural Resources, California[2]	23, 453	22, 371	24, 393	23, 367	24, 122	24, 692	26, 814	27, 250	26, 124	26, 904	21, 334	21, 710	292, 534

[1] Monthly figures by districts from American Petroleum Institute.

[2] Monthly figures prorated from annual and semiannual totals.

[3] No pipe-line facilities available heretofore.

Petroleum produced in California, 1925–1929, by counties [1]

[Thousands of barrels of 42 U. S. gallons]

County	1925	1926	1927	1928	1929
Fresno	7,774	7,340	7,202	4,611	3,498
Kern	58,853	54,550	51,570	44,097	43,577
Kings		(2)	(2)	199	1,969
Los Angeles	121,214	105,826	103,626	120,549	182,444
Orange	32,734	37,989	46,594	37,101	25,862
San Luis Obispo	30	28	17	15	(2)
Santa Barbara	2,647	1,925	2,174	3,078	11,142
Santa Clara	[3] 18	[4] 21	[5] 16	[6] 18	[7] 38
Ventura	9,222	16,994	19,997	22,143	24,004
	232,492	224,673	231,196	231,811	292,534

[1] Division of Mines, Department of Natural Resources, California.

[2] Included under Santa Clara.

[3] Includes San Mateo and San Bernardino.

[4] Includes Kings, San Bernardino, San Mateo, and Sonoma.

[5] Includes Colusa, Kings, San Bernardino, San Mateo, and Sonoma.

[6] Includes Colusa and San Mateo.

[7] Includes Colusa and San Luis Obispo.

Petroleum produced in California, 1928 and 1929, by fields

[Barrels of "clean oil," from Division of Mines, Department of Natural Resources, California]

Field	1928			1929		
	Jan. 1 to June 30	July 1 to Dec. 31	Total	Jan. 1 to June 30	July 1 to Dec. 31	Total
District No. 1:						
Beverly Hills	66,249	68,312	134,561	66,778	72,475	139,253
Brea Olinda	2,926,456	2,861,797	5,788,253	2,391,638	2,422,542	4,814,180
Coyote Hills	2,476,011	2,377,196	4,853,207	2,109,839	2,022,616	4,132,455
Dominguez	2,322,576	1,991,176	4,313,752	1,884,787	1,701,409	3,586,196
Huntington Beach	10,188,215	9,464,762	19,652,977	8,185,438	7,763,085	15,948,523
Inglewood	5,517,293	5,210,471	10,727,764	4,518,244	4,272,569	8,790,813
Lawndale		20,810	20,810	196,797	193,140	389,937
Long Beach	26,854,650	35,663,810	62,518,460	33,020,847	27,847,759	60,868,606
Montebello	2,243,288	2,077,168	4,320,456	1,917,030	1,718,075	3,635,105
Newhall	31,807	31,854	63,661	30,877	31,065	61,942
Newport	4,413	10,828	15,241	9,355	6,654	16,009
Playa del Rey					25,121	25,121
Potrero	34,141	73,243	107,384	119,045	141,162	260,207
Richfield	3,582,054	3,209,211	6,791,265	2,999,249	2,765,579	5,764,828
Rosecrans	1,260,141	1,133,482	2,393,623	1,178,615	1,259,057	2,437,672
Salt Lake	149,836	152,794	302,630	153,574	144,154	297,728
Santa Fe Springs	6,826,619	9,200,341	16,026,960	33,048,873	43,970,430	77,019,303
Seal Beach	7,107,440	5,311,436	12,418,876	7,330,059	7,110,857	14,440,916
Torrance	3,406,022	3,025,760	6,431,782	2,561,261	2,428,642	4,989,903
Whittier	307,592	303,192	610,784	279,718	282,661	562,379
	75,304,803	82,187,643	157,492,446	102,002,024	106,179,052	208,181,076
Los Angeles City field	[1] 81,850	[1] 80,000	161,850	[1] 62,000	[1] 63,024	125,024
District No. 2:						
Bardsdale	141,226	137,544	278,770	125,417	114,669	240,086
Conejo	300	1,078	1,378	231	1,786	2,017
Ojai	34,556	36,878	71,434	36,095	20,005	56,100
Piru	68,912	84,877	153,789	85,409	79,281	164,690
Rincon	342,913	761,301	1,104,214	622,288	571,021	1,193,309
Santa Paula	12,786	11,191	23,977	14,012	9,400	23,412
Sespe	30,327	27,371	57,698	31,837	26,959	58,796
Simi	21,399	21,155	42,554	22,542	21,335	43,877
South Mountain	705,801	699,428	1,405,229	609,062	607,569	1,216,631
Ventura	9,279,095	9,725,180	19,004,275	10,271,553	10,733,498	21,005,051
	10,637,315	11,506,003	22,143,318	11,818,446	12,185,523	24,003,969
District No. 3:						
Arroyo Grande	7,230	7,910	15,140	7,798	16,487	24,285
Casmalia	12,503	10,901	23,404	15,689	11,332	27,021
Cat Canyon	564,326	452,030	1,016,356	356,965	265,794	622,759
Elwood		859,560	859,560	4,451,237	5,000,947	9,452,184
Goleta	33,920	9,704	43,624	2,402	62	2,464
Lompoc	7,470	17,360	24,830	184		184
Moody Gulch	423		423			

[1] Semiannual figures for Los Angeles City field estimated.

Petroleum produced in California, 1928 and 1929, by fields—Continued

[Barrels of "clean oil," from Division of Mines, Department of Natural Resources, California]

Field	1928			1929		
	Jan. 1 to June 30	July 1 to Dec. 31	Total	Jan. 1 to June 30	July 1 to Dec. 31	Total
District No. 3—Cont.						
San Luis Obispo County—Huasna district					4,416	4,416
Santa Barbara County—						
El Capitan district					2,795	2,795
Mesa district					19,430	19,430
Santa Maria	551,333	513,219	1,064,552	500,710	433,912	934,626
Sargent	6,611	6,712	13,323	5,281	4,125	9,402
Summerland[2]	22,821	22,956	45,777	22,821	57,509	80,330
	1,206,637	1,900,352	3,106.989	5,363,087	5,816,809	11,179,896
District No. 4:						
Belridge-Lost Hills-Devils Den	746,037	769,401	1,515,438	829,556	824,744	1,654,300
Elk Hills	4,342,803	3,761,475	8,104,278	3,226,333	3,106,772	6,333,105
Fruitvale				171,506	462,250	633,756
Kern County	18,132	138,062	156,194	731		731
Kern River	2,953,980	1,940,117	4,894,097	2,829,072	3,067,560	5,896,632
McKittrick-Temblor	896,480	892,432	1,788,912	821,878	827,611	1,649,489
Midway-Sunset	13,773,178	13,430,292	27,203,470	12,462,964	12,644,584	25,107,548
Mount Poso	16,596	36,448	53,044	275,639	1,550,562	1,826,201
Round Mountain	36,332	16,358	52,690	9,745	215,187	224,932
Wheeler Ridge	168,747	159,768	328,515	130,206	120,520	250,726
	22.952,285	21,144,353	44,096,638	20,757,630	22,819,790	43,577,420
District No. 5:						
Coalinga	2,729,523	1,881,917	4,611,440	1,748,199	1,749,908	3,498,107
Kettleman Hills	393	198,391	198,784	646,232	1,322,497	1,968,729
	2,729.916	2,080,308	4,810,224	2,394,431	3,072,405	5,466,836
Grand total	[1] 112,912.806	[1] 118,898,659	231,811,465	[1] 142,397,618	[1] 150,136,603	292,534,221

[1] Semiannual figures for Los Angeles City field estimated.

[2] Estimated

Colorado.—Activity was curtailed materially in Colorado in 1929; only 98 wells were drilled, compared with 140 in 1928. The total production in the State amounted to 2,358,000 barrels in 1929, compared with 2,774,000 barrels in 1928. All the fields of any importance showed decline in output in 1929. One new oil field—Berthoud—and several new gas fields were discovered during the year. Deeper drilling received considerable attention, and the Morrison and Sundance sands were proved for production in several fields.

Petroleum produced in Colorado, 1920–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Boulder	Florence	Fort Collins[1]	Iles Dome	Moffat	Rangely	Tow Creek	Total
1920	7	88				16		111
1921	5	83				20		108
1922	4	70				23		97
1923	4	62				20		86
1924	4	70	86		256	29		445
1925	3	97	430	17	605	32	42	1,226
1926	2	148	1,222	24	1,199	33	140	2,768
1927	(2)	[3] 291	1,260	263	670	[4] 69	278	2,831
1928	(2)	[3] 430	1,030	626	464	[4] 34	190	2,774
1929	(2)	[3] 344	824	546	436	[5] 35	173	2,358

[1] Includes Wellington.

[2] Included with Rangely.

[3] Includes Canon City.

[4] Includes Boulder and Walden.

[5] Includes Berthoud, Boulder, and Walden.

Petroleum produced in Colorado, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Boulder Rangely[1]	2	1	2	3	3	2	2	3	3	4	2	3	30	4	34
Florence[2]	28	34	37	39	41	34	38	32	34	36	39	38	430	------	430
Fort Collins[3]	101	96	109	94	91	80	83	80	75	76	73	72	1,030	------	1,030
Iles Dome	37	52	51	27	31	57	67	69	48	57	52	53	601	25	626
Moffat	37	33	48	44	38	34	35	39	33	39	35	27	442	22	464
Tow Creek	15	13	13	13	18	18	22	17	15	15	16	15	190	------	190
	220	229	260	220	222	225	247	240	208	227	217	208	2,723	51	2,774
1929															
Boulder Rangely[4]	3	2	2	4	2	3	3	3	2	4	2	2	32	3	35
Florence[2]	34	31	36	31	30	28	30	28	25	23	21	22	339	5	344
Fort Collins[3]	84	73	79	74	76	73	70	66	62	58	53	56	824	------	824
Iles Dome	51	41	44	36	48	55	52	49	48	34	31	33	522	24	546
Moffat	26	29	28	26	48	42	44	31	32	39	30	35	410	26	436
Tow Creek	16	9	16	17	17	15	14	12	13	11	13	17	170	3	173
	214	185	205	188	221	216	213	189	182	169	150	165	2,297	61	2,358

[1] Includes Walden.
[2] Includes Canon City.
[3] Includes Wellington.
[4] Includes Berthoud and Walden.

Illinois.—The most important event of the year in Illinois was the discovery and development of the Dupo field in St. Clair County. The producing formation in this field is very shallow, and 225 oil wells were completed from the time the field was brought in, in January, until the end of the year, compared with only 89 wells completed in the rest of the State during the entire year. Despite the new production from the Dupo field the steady decline in the output of the State continued, and the total for 1929 amounted to 6,319,000 barrels, compared with 6,462,000 barrels in 1928

Petroleum produced in Illinois, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	662	604	728	586	661	665	690	647	667	677	639	637	7,863
1926	635	600	729	579	650	662	680	670	657	651	616	631	7,760
1927	589	558	698	536	601	602	576	607	577	557	562	531	6,994
1928	510	516	635	468	573	550	551	573	506	558	508	514	6,462
1929	508	455	603	457	552	517	561	572	532	566	506	490	6,319

Indiana.—Production in Indiana, after showing a material increase to 1,052,000 barrels in 1928, dropped to 981,000 barrels in 1929. The major part of the production in Indiana continued to come from the fields in the southwestern part of the State. Output from the other producing district, the fields in the northeastern part of the State adjoining the Lima field in Ohio, has declined steadily and amounts to an average of only about 5,000 barrels per month.

Petroleum produced in Indiana, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
Southwestern Indiana:													
1925	56	53	50	58	54	58	59	51	54	54	49	53	649
1926	54	55	50	54	57	56	56	54	54	53	56	59	658
1927	55	59	55	53	59	60	60	66	63	66	64	66	726
1928	70	75	71	75	81	78	81	86	82	88	87	89	963
1929	83	81	77	76	78	71	72	75	71	78	78	78	918
Northeastern Indiana:													
1925	15	15	18	18	16	17	17	16	14	12	11	11	180
1926	10	13	14	13	13	14	14	14	13	12	9	11	150
1927	9	12	12	12	12	13	11	10	10	9	8	8	126
1928	7	8	7	8	9	8	7	8	7	8	6	6	89
1929	4	4	6	6	6	7	5	5	5	5	5	5	63
Total Indiana:													
1925	71	68	68	76	70	75	76	67	68	66	60	64	829
1926	64	68	64	67	70	70	70	68	67	65	65	70	808
1927	64	71	67	65	71	73	71	76	73	75	72	74	852
1928	77	83	78	83	90	86	88	94	89	96	93	95	1,052
1929	87	85	83	82	84	78	77	80	76	83	83	83	981

Kansas.—The number of oil wells completed in Kansas in 1929 was slightly under the 1928 figure; the output in 1929, however, amounted to 42,813,000 barrels, compared with 38,596,000 barrels in 1928. The 1929 total has been exceeded but once in the history of crude production in Kansas—in 1918, when the Eldorado field was at its peak.

The most important factor in the increased output of Kansas in 1929 was the development of the Valley Center pool of Sedgwick County. This field was discovered in 1928 but did not strike its real stride as a producer until April and May of 1929. The total production of Sedgwick County in 1929 amounted to 8,900,000 barrels, of which about 7,100,000 barrels came from the Valley Center pool and slightly more than 1,000,000 barrels from the Greenwich pool, a new development in 1929. Other important fields discovered in Kansas in 1929 were Voshell, McPherson County; Schurr, Rice County; and Caldwell, Sumner County. The Ritz pool in McPherson County, in which several unusually large wells were completed, was discovered on December 28, 1928, but production did not really begin until 1929.

Wildcatting was extremely active in western Kansas in 1929, and a number of important strikes were made. The majority of these occurred on large blocks of acreage controlled by one company but in most instances no attempt was made to develop a substantial production.

Petroleum produced in Kansas, 1928 and 1929, by districts and months[1]

[Thousands of barrels of 42 U. S. gallons]

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1928													
Anderson	61	55	57	55	58	55	59	53	51	53	51	53	661
Butler:													
Eldorado	222	203	230	215	223	215	214	228	217	223	215	215	2,620
Leon-Weaver	102	98	106	113	113	108	114	183	209	225	218	202	1,791
Other	486	444	476	444	450	430	434	444	418	429	414	410	5,279
Cowley:													
Rainbow	49	44	47	44	43	41	40	36	34	33	30	31	472
Winfield-New Salem	88	72	80	70	71	69	66	64	58	57	54	55	804
Other	96	88	94	89	93	86	86	80	75	75	72	74	1,008
Greenwood-Woodson:													
Seely	245	224	233	222	223	216	222	203	187	192	186	177	2,530
Teeter-Pixley	233	217	226	208	209	201	200	199	184	182	175	178	2,412
Virgil	216	219	246	258	250	240	241	224	234	225	216	212	2,781
Other	198	181	194	192	194	185	186	178	168	165	147	161	2,149
Russell	72	81	93	91	111	105	128	138	122	127	124	112	1,304
Sedgwick	------	------	------	------	------	------	------	------	50	46	112	171	379
Sumner	695	661	736	874	779	732	663	600	565	536	494	453	7,788
Woodson	32	28	33	32	31	30	30	30	12	25	24	29	336
Other	524	465	528	505	520	489	489	487	463	466	446	455	5,837
	3,319	3,080	3,379	3,412	3,368	3,202	3,172	3,147	3,047	3,059	2,978	2,988	38,151
Bureau of Mines[2]	3,362	3,248	3,561	3,422	3,444	3,274	3,283	3,222	2,912	3,073	2,828	2,967	38,596
1929													
Anderson	52	42	43	43	44	44	47	47	55	55	55	56	583
Butler:													
Eldorado	209	192	224	217	219	212	220	225	224	228	211	217	2,598
Leon-Weaver	184	157	180	169	172	168	165	159	134	163	145	148	1,944
Other	386	339	389	376	386	374	407	411	389	412	430	431	4,730
Cowley:													
Rainbow	28	23	40	39	40	33	40	40	41	43	36	36	439
Winfield-New Salem	55	49	43	40	86	60	81	73	66	71	67	69	760
Other	68	76	63	68	73	70	74	71	69	76	78	80	866
Greenwood-Woodson:													
Seely	168	147	188	187	192	186	242	241	228	249	236	246	2,510
Teeter-Pixley	160	146	159	160	161	156	159	155	152	142	143	145	1,838
Virgil	184	162	170	157	161	156	163	165	167	177	173	177	2,012
Other	139	120	131	139	140	135	135	129	124	128	119	122	1,561
McPherson	------	------	7	7	7	7	6	6	6	7	118	116	287
Russell	107	95	108	102	110	105	108	106	102	106	118	121	1,288
Sedgwick	199	197	323	631	975	1,098	1,125	1,088	1,114	724	671	755	8,900
Sumner	428	383	398	363	405	387	402	394	390	359	328	330	4,567
Woodson	29	26	29	27	28	27	28	28	27	28	33	33	343
Other	466	404	456	388	466	418	465	478	493	461	470	467	5,432
	2,862	2,558	2,951	3,113	3,665	3,636	3,867	3,816	3,781	3,429	3,431	3,549	40,658
Bureau of Mines[2]	2,939	2,717	3,093	3,385	3,812	3,795	4,323	4,194	3,963	3,681	3,427	3,484	42,813

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[1] Monthly estimates by districts from Oil and Gas Journal.

[2] Separation by fields not available.

Kentucky.—Production in Kentucky showed a gain in 1929 for the third successive year, and amounted to 7,775,000 barrels, or 6 per cent more than in 1928. Ohio and Daviess Counties were the most active areas in the State in 1929 and supplied the major part of the new production in that year. According to records of the Kentucky State Tax Commission, the production in Ohio and Daviess Counties amounted to 2,785,995 and 1,065,883 barrels, respectively, in 1929. The total output in these counties was 50 per cent of the total output in the State.

Petroleum produced in Kentucky, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	575.7	544.4	592.4	579.5	580.6	567.2	598.6	556	561.6	552.8	534.2	516	6,759
1926	499	485	531	517	522	526	549	540	532	536	521	516	6,274
1927	509	490	549	540	559	558	586	612	587	588	586	555	6,719
1928	542	558	623	618	653	563	681	662	594	660	608	597	7,359
1929	585	511	560	584	636	547	710	676	722	810	724	710	7,775

Petroleum produced in Kentucky, 1925–1929, by counties, in barrels[1]

County	1925	1926	1927	1928	1929
Allen	304,579	280,228	254,745	229,306	204,680
Barren	253,561	341,812	362,510	489,226	226,899
Bath	16,805	14,872	12,372	8,091	7,464
Boyd	992	712	783	497	1,294
Breckinridge				240	654
Clinton	11,031	11,894	44,336	1,573	926
Cumberland	69,805	45,317	55,432	24,676	17,225
Daviess	12,321	22,487	48,925	661,002	1,065,883
Elliott	8,240	9,727	9,278	8,571	6,983
Estill	436,483	401,876	374,772	340,820	306,550
Floyd	7,873	13,494	7,187	7,695	29,643
Hancock	33,578	30,999	22,665	16,117	15,020
Hopkins	15,073	14,692	11,305	9,062	6,636
Jackson	583	1,239	1,175	1,298	418
Johnson	1,026,322	968,284	862,909	707,657	598,972
Knott	2,634	1,876	2,022	1,857	627
Lawrence	665,795	688,124	631,420	533,734	466,489
Lee	1,775,004	1,449,526	1,248,195	1,091,394	967,032
Lincoln	50				
Logan	564	661	433	482	569
Magoffin	890,117	780,901	706,256	588,820	510,050
Martin	3	11	19		
McCreary	3,751	6,418	9,537	8,209	6,273
McLean				2,578	4,456
Menifee	1,936	1,573	1,613	894	514
Monroe	22,621	6,788	3,857	2,805	1,887
Morgan	8,148	6,999	6,356	5,446	4,252
Muhlenberg					35,409
Ohio	165,040	362,909	1,326,055	2,022,446	2,785,995
Owsley	16,167	13,605	19,976	9,879	6,471
Powell	212,582	172,688	146,546	125,414	112,163
Russell	1,917				
Simpson	8,953	7,089	5,268	4,000	3,058
Warren	489,646	408,807	320,587	253,451	209,421
Wayne	134,142	108,229	90,844	86,983	77,342
Wolfe	52,538	53,969	54,644	56,866	47,692
	6,648,854	6,227,806	6,642,022	7,301,089	7,728,947
Bureau of Mines	6,759,000	6,274,000	6,719,000	7,359,000	7,775,000

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[1] Kentucky State Tax Commission.

Louisiana.—The production record for Louisiana in 1929 was similar to that in 1928 in that the decrease in output in the northern fields was partly compensated for by an increase in the Gulf coast area. The total output for the State in 1929 was 20,554,000 barrels, with one exception the lowest figure since 1919.

Contrary to expectations, drilling activity in Louisiana increased materially in 1929 and 302 oil wells were completed, compared with 202 in 1928. In spite of the completion of 147 wells in the northern fields in 1929, production in practically every pool declined. The only new developments of importance were the finding of considerable production at Zwolle, discovered late in 1928, and the conversion of the Carterville district from a declining gas field into an oil field. The production of the fields on the Louisiana Gulf coast reached a new high level of 7,454,000 barrels in 1929, an increase of 401,000 barrels over 1928. Production from the majority of the pools in this district declined in 1929, but the losses were more than compensated for by gains in output from the Hackberry, Jennings, and Sulphur fields. A number of new salt-dome pools entered the producing column in 1929, namely, Lake Barre, Port Barre, Bayou Bleu, Black Bayou, Dog Lake, Lake Pelto, and White Castle.

Petroleum produced in Louisiana, 1920–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

District	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Gulf coast (salt-dome pools)										
Anse la Butte	-------	47	36	18	12	17	17	17	16	14
Bayou Bouillon	-------	-------	-------	-------	-------	-------	-------	-------	205	72
Edgerley	379	250	125	157	166	185	207	467	358	245
Hackberry	-------	-------	-------	-------	-------	-------	-------	42	1,149	1,783
Jennings	232	254	191	204	213	278	342	299	250	515
Lake Barre	-------	-------	-------	-------	-------	-------	-------	-------	-------	46
Lockport	-------	-------	-------	-------	128	471	1,343	2,038	1,445	1,369
Port Barre	-------	-------	-------	-------	-------	-------	-------	-------	-------	33
Sorrento	-------	-------	-------	-------	-------	-------	-------	-------	289	110
Starks	-------	-------	-------	-------	-------	-------	-------	262	186	170
Sulphur	-------	-------	-------	-------	-------	-------	-------	(1)	890	1,374
Sweet Lake	-------	-------	-------	-------	-------	-------	(1)	77	661	93
Vinton	1,333	1,379	1,395	2,071	1,968	2,274	2,215	1,786	1,569	1,484
Other	3	-------	-------	-------	-------	[2] 2	[3] 16	[4] 62	[5] 35	[6] 146
	1,947	1,930	1,747	2,450	2,487	3,227	4,140	5,050	7,053	7,454
Northern										
Bellevue	-------	-------	1,050	2,351	1,749	1,129	788	472	323	255
Caddo	6,336	5,342	4,498	4,178	4,319	4,067	4,749	5,789	4,798	[7] 4,589
Cotton Valley	-------	-------	-------	-------	1,211	3,348	2,914	1,968	1,731	1,040
De Soto	(8)	719	531	429	353	305	321	541	463	276
Elm Grove	-------	-------	160	220	217	212	222	222	185	178
Haynesville	-------	3,161	19,939	10,496	6,720	4,604	3.328	2,600	2.150	1,806
Homer	21,508	13,030	5,673	3,581	2,837	2,296	2,033	1,785	1,548	1,405
Red River (Bull Bayou, Crichton)	[8] 5,923	2,844	1,778	1,207	1,231	1,074	1,037	1,070	1,109	987
Urania	-------	-------	-------	-------	-------	10	3,669	3,321	2,487	2,155
Zwolle	-------	-------	-------	-------	-------	-------	-------	-------	-------	[9] 409
Other	-------	77	-------	7	-------	-------	-------	-------	-------	-------
	33,767	25,173	33,629	22,469	18,637	17,045	19,061	17,768	14,794	13,100
	35,714	27,103	35,376	24,919	21,124	20,272	23,201	22,818	21,847	20,554

[1] Included under "Other."
[2] Welsh.
[3] Sweet Lake and Welsh.
[4] Iberia, Sulphur, and Welsh.
[5] Iberia and Welsh.
[6] Bayou Bleu, Black Bayou, Dog Lake, Lake Pelto, Welsh, and White Castle.
[7] Includes Carterville and Sarepta.
[8] De Soto included with Red River.
[9] Includes Pleasant Hill.

Petroleum produced in Louisiana, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Gulf coast (salt-dome pools)															
Anse la Butte[1]	2	1	1	2	4	4	5	5	1	2	2	3	32	19	51
Bayou Bouillon	-----	-----	34	19	14	19	18	19	30	21	19	12	205	-----	205
Edgerley	50	48	32	27	25	29	32	27	23	21	20	24	358	-----	358
Hackberry	28	33	54	46	95	126	144	130	81	83	130	158	1, 108	41	1, 149
Jennings	20	20	24	21	15	19	18	22	21	18	21	21	240	10	250
Lockport	152	133	126	133	123	118	111	107	105	104	110	123	1, 445	-----	1, 449
Sorrento	-----	22	17	2	1	54	52	35	29	21	17	37	287	2	285
Starks	7	6	4	5	4	3	17	21	28	22	23	25	165	21	186
Sulphur	-----	-----	-----	37	51	147	134	156	89	76	53	48	791	99	890
Sweet Lake	19	22	21	-----	-----	103	114	123	94	64	46	28	634	27	661
Vinton	137	128	145	129	136	134	133	131	125	123	121	121	1, 563	6	1, 569
	415	413	458	421	468	756	778	776	626	555	562	600	6, 828	225	7, 035
Northern															
Bellevue	30	29	36	30	28	24	21	23	23	25	31	23	323	-----	323
Caddo	498	432	412	366	421	376	394	397	368	380	392	360	4, 796	2	4, 798
Cotton Valley	139	132	135	244	189	147	145	135	123	128	114	103	1, 734	−3	1, 731
De Soto	45	40	42	37	38	36	36	40	36	39	36	36	461	2	463
Elm Grove	17	15	15	16	18	15	15	15	14	14	14	14	182	3	185
Haynesville	191	180	195	184	193	182	179	180	168	174	165	162	2, 153	−3	2, 150
Homer	132	126	140	131	134	129	129	129	123	127	121	127	1, 548	-----	1, 548
Red River (Bull Bayou, Crichton)	94	88	96	93	95	94	94	94	90	93	87	91	1, 109	-----	1, 109
Urania	227	223	231	205	226	218	206	209	189	192	176	180	2, 482	5	2, 487
	1, 373	1, 265	1, 302	1, 306	1, 342	1, 221	1, 219	1, 222	1, 134	1, 172	1, 136	1, 096	14, 788	6	14, 794
	1, 788	1, 678	1, 760	1, 727	1, 810	1, 977	1, 997	1, 998	1, 760	1, 727	1, 698	1, 696	21, 616	231	21, 847
1929															
Gulf coast (salt-dome pools)															
Anse la Butte	1	1	1	1	1	1	1	1	-----	1	1	-----	10	4	14
Bayou Bouillon	11	9	7	8	6	6	5	4	3	3	3	1	66	6	72
Edgerley	22	21	23	23	21	20	19	21	18	16	17	24	245	-----	245
Hackberry	184	153	171	193	153	136	148	124	120	118	117	125	1, 742	41	1, 783
Jennings	17	19	19	22	23	67	87	61	57	48	39	48	507	8	515
Lockport	129	127	129	109	119	112	102	102	115	120	106	97	1, 367	2	1, 369
Sorrento	29	16	14	10	7	6	1	-----	8	-----	4	-----	95	15	110
Starks	22	15	14	12	11	9	9	11	10	11	10	14	148	22	170
Sulphur	166	53	64	76	76	59	58	104	138	207	158	101	1, 260	114	1, 374
Vinton	121	109	130	115	111	123	132	126	131	131	126	121	1, 476	8	1, 484
Other[2]	25	20	15	15	23	22	12	17	12	26	22	42	251	67	318
	727	543	587	584	551	561	574	571	612	681	603	573	7, 167	287	7, 454
Northern															
Bellevue	24	20	21	20	22	24	24	22	20	20	18	20	255	-----	255
Caddo[3]	333	320	349	339	344	355	384	377	467	497	401	410	4, 576	13	4, 589
Cotton Valley	91	86	97	83	89	83	83	78	82	90	82	88	1, 032	8	1, 040
De Soto	25	23	24	26	25	22	25	23	21	22	20	20	276	-----	276
Elm Grove	13	15	17	15	14	15	14	13	13	12	12	11	164	14	178
Haynesville	164	143	166	157	159	145	155	148	145	149	143	140	1, 814	8	1, 806
Homer	123	110	125	121	121	117	120	119	112	116	110	111	1, 405	-----	1, 405
Red River (Bull Bayou, Crichton)	92	81	88	87	83	80	83	86	76	79	76	76	987	-----	987
Urania	181	165	182	192	197	191	198	180	176	174	165	168	2, 169	14	2, 155
Zwolle[4]	10	10	13	11	10	11	12	28	28	29	97	147	406	3	409
	1, 056	973	1, 082	1, 051	1, 064	1, 043	1, 098	1, 074	1, 140	1, 188	1, 124	1, 191	13, 084	16	13, 100
	1, 783	1, 516	1, 669	1, 635	1, 615	1, 604	1, 672	1, 645	1, 752	1, 869	1, 727	1, 764	20, 251	303	20, 554

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[1] Includes Iberia and Welsh.

[2] Includes Bayou Bleu, Black Bayou, Dog Lake, Lake Barre, Lake Pelto, Port Barre, Sweet Lake, Welsh, and White Castle.

[3] Includes Carterville and Sarepta.

[4] Includes Pleasant Hill.

Michigan.—Michigan experienced an active year in 1929. Production rose from 594,000 barrels in 1928 to 4,528,000 barrels in 1929. The year witnessed the rapid development of the Muskegon field, which produced the major part of the State's output in 1929. Production in this field reached its peak in July but declined rapidly, and at the close of the year the output was below that of the Midland, or Mount Pleasant, field. Compared with the Muskegon field, the Mount Pleasant pool was very conservatively developed; although its wells lacked the high initial production of the Muskegon wells, the producing life of the field will undoubtedly be much longer. The greater part of the wildcatting in 1929 was carried on in the central part of the State near the Mount Pleasant field. Many wells in the Muskegon field were deepened with some success from the Traverse to the Dundee sand.

Petroleum produced in Michigan, 1927–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Mount Pleasant	Muskegon	Saginaw	Total
1927		(1)	[1] 439	439
1928	(2)	338	[2] 256	594
1929	1,394	3,019	115	4,528

[1] Muskegon included with Saginaw. [2] Mount Pleasant included with Saginaw.

Petroleum produced in Michigan in 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
Mount Pleasant	12	22	41	40	42	64	110	149	187	239	243	224	1,373	21	1,394
Muskegon	135	97	93	107	179	405	574	464	298	270	209	176	3,007	12	3,019
Saginaw	11	10	10	10	10	9	10	9	9	9	8	9	114	1	115
	158	129	144	157	231	478	694	622	494	518	460	409	4,494	34	4,528

Montana.—In spite of increased drilling activity, production in Montana continued to decline and in 1929 amounted to only 3,980,000 barrels, compared with 4,015,000 barrels in 1928. Pondera was the only field in the State to show increased production; its output amounted to 1,057,000 barrels in 1929, compared with 150,000 barrels in 1928.

Petroleum produced in Montana, 1920–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Cat Creek	Elk Basin	Kevin-Sunburst	Lake Basin	Pondera	Other	Total
1920	243	97					340
1921	1,408	75				26	1,509
1922	2,333	46	36			34	2,449
1923	2,227	28	523			4	2,782
1924	1,572	24	1,217			2	2,815
1925	1,255	21	2,780	31		4	4,091
1926	1,015	19	6,630	63			7,727
1927	[1]779	17	4,214	48			5,058
1928	[1]613	20	3,189	43	150		4,015
1929	[1]497	19	2,378	29	1,057		3,980

[1] Includes small amounts from Bannatyne and Devils Basin.

Petroleum produced in Montana, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Cat Creek [1]	54	51	55	52	53	52	50	50	51	46	45	46	605	8	613
Elk Basin	1	1	2	1	1	1	1	2	2	2	2	2	18	2	20
Kevin-Sunburst	320	295	297	265	289	254	241	277	263	227	227	238	3,193	−4	3,189
Lake Basin	2	3	3	3	3	2	2	9	4	5	5	5	46	−3	43
Pondera								9	15	28	36	59	147	3	150
	377	350	357	321	346	309	294	347	335	308	315	350	4,009	6	4,015
1929															
Cat Creek [1]	44	35	45	42	43	42	43	43	40	38	37	38	490	7	497
Elk Basin	2	1	2	2	2	2	2	2	1	1	1	1	19		19
Kevin-Sunburst	180	155	208	207	217	207	207	209	200	209	194	180	2,373	5	2,378
Lake Basin	2	2	3	2	2	2	6	2	2	2	2	2	29		29
Pondera	81	68	79	84	95	95	96	94	90	83	74	72	1,011	46	1,057
	309	261	337	337	359	348	354	350	333	333	308	293	3,922	58	3,980

[1] Includes small amounts from Bannatyne and Devils Basin.

New Mexico.—The year 1929 was an outstanding one for New Mexico, as it marked the discovery of the Hobbs field, the first major pool found in the State. The Hobbs field is in Lea County, just inside the New Mexico-Texas line, and marks a continuation of the west Texas lime. The total production of the State in 1929 amounted to 1,830,000 barrels, or nearly double the 1928 output. The light-oil fields of San Juan County also showed increased production in 1929, but the major part of the total gain was recorded in Lea County, where a number of new oil and gas areas were opened up. The most important of these new areas, from the standpoint of production in 1929, were Jal and Lea; the Hobbs field was discovered in 1928, but most of the drilling in 1929 was on the edges of the structure and the wells were small.

Petroleum produced in New Mexico, 1925–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Artesia	Hogback	Lea	Rattlesnake[1]	Total
1925	748	187	----------	125	1,060
1926	1,016	221	2	427	1,666
1927	582	223	39	382	1,226
1928	410	169	69	295	943
1929	323	120	[2] 899	488	1,830

[1] Includes Bloomfield in 1925; Bloomfield and Table Mesa in 1926; Bloomfield, Hospah, and Table Mesa in 1927 and 1928; and Hospah and Table Mesa in 1929.
[2] Includes Hobbs, Jal, Maljamar, and other pools in Lea County.

Petroleum produced in New Mexico, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Artesia	40	34	38	37	37	34	33	33	29	33	30	30	408	2	410
Hogback	21	14	17	15	12	6	8	14	15	15	16	16	169	------	169
Lea	7	5	6	6	6	6	6	6	5	6	5	5	69	------	69
Rattlesnake[1]	11	13	15	14	18	18	42	31	17	35	39	56	309	−14	295
	79	66	76	72	73	64	89	84	66	89	90	107	955	−12	943
1929															
Artesia	29	27	28	28	29	25	26	27	24	25	23	24	315	8	323
Hogback	17	8	15	8	9	5	3	4	10	13	15	13	120	------	120
Lea	7	9	13	12	34	37	56	59	106	142	156	176	807	92	899
Rattlesnake[2]	22	22	35	30	23	19	48	55	76	61	44	34	469	19	488
	75	66	91	78	95	86	133	145	216	241	238	247	1,711	119	1,830

[1] Includes Bloomfield, Hospah, and Table Mesa. [2] Includes Hospah and Table Mesa.

New York.—The production of crude petroleum in New York in recent years has increased consistently; in 1929 it amounted to 3,377,000 barrels, approximately double the output in 1925 and 30 per cent higher than that in 1928. The gain in output in New York in the last few years has resulted from drilling and water flooding in the Bradford field; this district lies in both New York and Pennsylvania.

Petroleum produced in New York, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	125	122	139	134	138	146	150	148	147	152	144	150	1,695
1926	147	141	158	165	156	162	174	167	171	176	158	181	1,956
1927	169	169	195	185	191	189	184	200	192	189	187	192	2,242
1928	185	181	195	192	211	225	200	230	219	249	251	265	2,603
1929	262	240	267	277	295	284	301	285	282	288	281	315	3,377

Ohio.—Although drilling in Ohio gained materially, the total output of the State declined from 7,015,000 barrels in 1928 to 6,743,000 barrels in 1929. This decline in output was shared by both the producing districts into which the State is divided—the central and eastern part, which produces mainly high-grade oil, and the Lima field of northwestern Ohio, which produces oil of much lower quality.

Petroleum produced in Ohio, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
Central and eastern Ohio:													
1925	409	393	438	447	428	453	458	447	450	460	423	466	5,272
1926	410	406	471	447	438	472	463	464	452	449	449	471	5,392
1927	454	453	536	502	527	512	487	518	492	482	473	448	5,884
1928	445	441	480	455	492	471	462	473	416	466	418	415	5,434
1929	431	388	442	441	456	431	489	430	422	468	423	438	5,259
Northwestern Ohio:													
1925	151	150	165	172	166	181	176	166	165	161	141	146	1,940
1926	147	145	165	158	163	181	169	160	156	154	137	145	1,880
1927	131	144	158	144	149	158	145	149	143	144	123	121	1,709
1928	117	123	138	129	154	149	152	137	122	133	110	117	1,581
1929	104	95	122	119	128	145	159	148	120	129	110	105	1,484
Total Ohio:													
1925	560	543	603	619	594	634	634	613	615	621	564	612	7,212
1926	557	551	636	605	601	653	632	624	608	603	586	616	7,272
1927	585	597	694	646	676	670	632	667	635	626	596	569	7,593
1928	562	564	618	584	646	620	614	610	538	599	528	532	7,015
1929	535	483	564	560	584	576	648	578	542	597	533	543	6,743

Oklahoma.—Production in Oklahoma amounted to 255,004,000 barrels in 1929, compared with 249,857,000 barrels in 1928. The output in 1929 would have been much larger if rigid proration had not been followed in the Oklahoma City and other flush fields.

The development of the Oklahoma City field, discovered late in 1928, was the most interesting phase of the industry in Oklahoma in 1929. Wells in this field were completed rapidly, and nearly all of them were above the average in size. The total potential production of the field rose quickly to more than the pipe-line facilities, but the inauguration of a system of grading the wells, whereby they were allowed to produce only a small fraction of the time, greatly restricted the output. The total production of the field amounted to 8,710,000 barrels in 1929, compared with only 101,000 barrels in 1928. Thus, had it not been for this field the total production of the State would have declined in 1929.

The Seminole district held its rank as the chief producing area of the State; it yielded 101,392,000 barrels in 1929, compared with 105,728,000 barrels in 1928. These figures do not include the output of the St. Louis-Pearson field, which was nearly 10,000,000 barrels more than in 1928. In contrast to the usual custom more attention was given to the shallower formations than to deeper drilling in the Seminole area. For example, the Gilcrease or Cromwell sand, which lies approximately 1,000 feet above the Wilcox sand, was found to be productive of large wells in certain areas, and in some wells the casing was ripped opposite this sand with gratifying though not sensational results.

Production in the greater Seminole district was aided by the discovery of a few new pools and the extension of others. The most important extensions were East Earlsboro and East Little River. The new pools of consequence were Asher, Sasakwa, and Konawa. The Asher pool was opened auspiciously with several large wells, but most of the later completions were disappointing.

Wildcatting was active over the State, particularly in the area north and east of Oklahoma City. The discovery of the prolific Oklahoma City pool caused the center of wildcat operations to move westward, where the usual producing formations lie deeper and entail deeper drilling.

Prices of crude in Oklahoma were reduced in the latter part of January, when production appeared to be exceeding consumption. This price cut resulted in some reduction in output, which, in conjunction with the seasonal increase in runs to stills, caused a withdrawal of Oklahoma-Kansas-north Texas crude from stocks. This decline in stocks was taken as an indication that production had been sufficiently curtailed and prices were raised to slightly above what they had been before the January cut. However, the withdrawal from stock proved to be of short duration, and the price structure continued weak, though unchanged, over the remainder of the year.

Petroleum produced in Oklahoma, 1928 and 1929, by districts and months[1]

[Thousands of barrels of 42 U. S. gallons]

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1928													
Allen	286	304	324	427	640	638	661	646	675	726	751	881	6,959
Braman:													
North	93	89	88	90	89	87	93	90	84	85	76	78	1,042
South	59	55	59	52	48	46	47	46	38	44	37	38	569
Bristow-Kelleyville and Depew	558	515	490	460	462	445	463	462	441	454	433	442	5,625
Burbank	1,146	1,152	1,324	1,215	1,137	966	936	915	876	816	805	772	12,060
Cromwell	314	293	315	294	300	288	289	288	236	271	247	252	3,387
Cushing-Shamrock	547	521	530	523	533	517	546	576	559	548	569	552	6,521
Davenport	79	70	72	65	69	60	59	63	59	58	56	54	764
Duncan	169	149	187	193	197	189	187	211	217	222	167	177	2,265
Eastern Bristow	183	171	174	213	234	223	231	229	232	262	246	249	2,647
Fox-Graham	241	222	235	226	224	216	217	213	195	197	188	190	2,564
Garber	284	268	251	262	270	256	258	239	255	197	204	199	2,943
Glenn-Sapulpa and Kiefer	209	187	200	192	196	189	193	188	180	189	183	183	2,289
Grady County	168	189	194	180	175	168	193	191	189	196	154	165	2,162
Healdton	441	402	429	416	438	419	439	423	417	426	406	413	5,069
Henryetta, Deaner-Lyons, etc	222	275	303	251	254	245	247	224	218	223	210	209	2,881
Hewitt	276	255	272	281	293	283	292	297	269	276	269	275	3,338
Lovell-Marshall	65	116	197	190	179	173	196	316	283	291	270	417	2,693
Oklahoma City	------	------	------	------	------	------	------	------	------	------	------	101	101

[1] Monthly estimates by districts from Oil and Gas Journal.

Petroleum produced in Oklahoma, 1928 and 1929, by districts and months—Continued

[Thousands of barrels of 42 U. S. gallons]

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1928													
Osage (outside Burbank)	812	800	826	846	818	918	819	806	799	728	747	747	9,666
Papoose-Gilcrease	159	116	149	137	137	129	127	127	121	124	108	112	1,546
St. Louis-Pearson	259	334	450	453	496	681	1,224	2,047	3,333	3,910	3,890	4,158	21,235
Seminole	10,421	9,157	9,255	8,345	8,429	7,721	7,459	8,694	9,362	9,733	8,756	8,396	105,728
Sholem-Alechem	403	379	414	494	505	480	474	473	433	441	436	450	5,382
Tonkawa	476	428	456	425	432	414	416	392	373	372	347	347	4,878
Wewoka	260	263	240	225	214	195	190	177	164	167	161	159	2,415
Other	2,848	2,584	2,729	2,642	2,674	2,537	2,553	2,508	2,449	2,475	2,363	2,410	30,772
	20,978	19,294	20,163	19,097	19,443	18,483	18,809	20,841	22,457	23,431	22,079	22,426	247,501
Bureau of Mines [2]	21,040	19,166	19,980	18,921	19,745	19,009	19,175	21,363	22,796	23,862	22,040	22,760	249,857
1929													
Allen	838	777	801	782	756	712	774	752	742	751	623	664	8,972
Asher	------	------	------	------	150	278	339	348	272	199	134	112	1,832
Braman	110	96	110	113	117	110	125	126	110	117	111	112	1,357
Bristow-Kelleyville and Depew	425	382	413	409	425	393	477	555	472	468	433	444	5,296
Burbank	772	688	691	634	650	593	641	588	554	552	531	542	7,436
Cromwell	244	215	248	245	252	239	251	245	234	232	228	235	2,868
Cushing-Shamrock	596	528	548	516	506	492	494	479	461	467	445	456	5,988
Davenport	54	46	52	49	46	44	70	59	54	53	51	51	629
Duncan	206	181	154	143	153	144	171	171	158	162	154	158	1,955
Eastern Bristow	250	248	258	231	229	210	209	196	182	177	165	170	2,525
Fox-Graham	131	167	180	180	178	169	176	169	159	166	157	160	1,992
Garber	187	166	181	172	177	171	167	165	151	155	138	144	1,974
Glenn	213	192	203	215	214	204	212	210	203	209	171	202	2,448
Grady County	99	141	142	126	128	123	125	121	104	109	102	103	1,423
Healdton	409	364	413	303	402	374	401	395	381	397	376	384	4,599
Henryetta, Deaner-Lyons	117	105	114	239	238	213	267	266	251	211	191	197	2,409
Hewitt	268	232	254	250	254	243	245	249	242	247	233	236	2,953
Lovell-Marshall	452	350	354	369	534	497	632	624	490	513	440	504	5,759
Oklahoma City	159	155	106	102	88	151	662	1,165	751	1,422	1,680	2,269	8,710
Osage (outside Burbank)	783	799	793	748	762	760	707	809	779	751	801	825	9,317
Papoose-Gilcrease	107	98	108	101	103	98	102	98	99	98	95	98	1,205
St. Louis-Pearson	4,093	3,395	3,203	3,121	3,000	2,624	2,370	2,169	1,900	1,747	1,587	1,607	30,816
Sasakwa	------	------	------	------	------	------	321	221	260	373	306	312	1,793
Seminole	8,759	8,258	8,267	8,004	8,914	8,795	9,450	9,346	9,387	8,134	7,042	7,036	101,392
Sholem-Alechem	406	350	405	402	408	391	394	394	386	434	422	437	4,829
Tonkawa	326	287	332	303	314	301	298	283	257	268	276	273	3,518
Wewoka	135	140	154	147	149	144	141	135	130	135	130	133	1,673
Other	2,437	2,104	2,354	2,331	2,198	2,088	2,151	2,092	2,130	2,275	2,172	2,229	26,561
	22,576	20,464	20,838	20,235	21,345	20,561	22,372	22,430	21,299	20,822	19,194	20,093	252,229
Bureau of Mines [2]	22,856	20,235	21,213	20,689	21,803	20,802	22,874	22,805	21,505	20,739	19,249	20,234	255,004

[2] Separation by fields not available.

Pennsylvania.—Production in Pennsylvania continued its steady increase in 1929 and the total amounted to 11,820,000 barrels, compared with 9,956,000 barrels in 1928. The 1929 output represents the highest total recorded for the State since 1902. The major part of the development work in Pennsylvania in 1929 was in the Bradford field, where 2,679 wells (including pressure and water intake wells) were completed, compared with 1,572 in 1928. Of the 1929 completions, only 5 were dry holes—a remarkable record. Water flooding was responsible for a large part of the increased output of the Bradford field. According to the Pennsylvania Department of Internal Affairs, the production of McKean County, in which the Bradford field lies, amounted to 7,734,945 barrels, or 66 per cent of the State total, in 1929, compared with 5,901,394 barrels, or 60 per cent of the total, in 1928.

Petroleum produced in Pennsylvania, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	613	593	684	697	669	700	708	704	701	710	651	667	8,097
1926	654	650	726	748	748	777	784	783	772	802	760	757	8,961
1927	718	728	842	799	812	824	789	830	805	820	793	766	9,526
1928	768	770	842	792	884	836	838	860	795	893	828	850	9,956
1929	851	805	913	943	1,020	953	1,037	1,043	972	1,120	1,053	1,110	11,820

Petroleum produced in Pennsylvania, 1925–1929, by counties, in barrels [1]

County	1925	1926	1927	1928	1929
Allegheny	453,648	422,797	406,771	375,062	349,497
Armstrong	20,093	19,718	19,420	18,319	19,564
Beaver	83,908	84,296	81,198	77,153	71,744
Butler	846,151	689,782	677,004	646,942	679,752
Clarion	208,807	209,965	190,365	189,740	195,665
Crawford	57,637	64,523	75,235	79,482	99,614
Elk	93,546	88,419	86,213	85,643	92,058
Fayette	--------	--------	--------	--------	1,721
Forest	131,162	137,078	127,814	160,577	102,017
Greene	302,938	439,576	370,612	228,199	276,263
Jefferson	8,527	21,167	7,687	6,744	5,966
Lawrence	22,537	19,348	27,319	24,921	21,435
McKean	[2] 2,575,089	[2] 2,962,698	5,535,157	5,901,394	7,734,945
Mercer	13,804	14,401	14,031	15,489	22,022
Potter	11,686	7,395	6,860	8,849	3,122
Tioga	5,916	2,441	--------	--------	--------
Venango	1,184,221	1,161,924	1,214,568	1,147,047	1,291,487
Warren	294,597	313,808	343,315	299,282	315,322
Washington	455,554	449,493	455,807	500.019	490,142
Westmoreland	186	--------	--------	--------	--------
	[2] 6,770,007	[2] 7,108,829	9,639,376	9,764,862	11,772,336
Bureau of Mines	[2] 8,097,000	[2] 8,961,000	9,526,000	9,956,000	11,820,000

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[1] Department of Internal Affairs, Pennsylvania.

[2] Differences in totals (1925 and 1926) due mainly to differences in production recorded for McKean County.

Tennessee.—Production in the Clay County fields, the most important producing area of Tennessee, declined steadily in 1929, and the total output for the State amounted to only 19,000 barrels, compared with 46,000 barrels in 1928.

Petroleum produced in Tennessee, 1925–1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	0.3	0.6	0.6	1.5	1.4	1.8	1.4	2	1.4	2.2	4.8	6	24
1926	3	4	3	5	4	4	3	2	5	3	4	3	43
1927	5	4	3	4	5	4	5	9	5	6	6	4	60
1928	2	4	5	4	5	2	5	8	4	2	3	2	46
1929	2	2	1	3	2	1	2	2	1	2	1	------	19

Texas.—The production of crude petroleum in Texas in 1929 amounted to 296,876,000 barrels, the highest total ever recorded for the State and an increase of 15 per cent over 1928. Texas retained first place among the producing States in 1929, although its margin over California was very narrow. The material increase in production in Texas in 1929 resulted primarily from a gain in drilling activity, 4,440 oil wells being brought in, compared with 3,980 in 1928. All the major districts of Texas, namely, north central Texas, east and south central Texas, Panhandle, west Texas, southwest Texas, and the Gulf coast,reported increases in output in 1929.

North central Texas, including those areas referred to as north Texas and west central Texas, experienced a good year in 1929 when production amounted to 52,046,000 barrels, compared with 49,459,000 barrels in 1928. This increase in output resulted primarily from increased drilling operations, but was also the result of repressuring and deepening of wells in the older fields. The most active counties were Archer, Coleman, Cooke, and Wilbarger. The producing sands in this area are nearly all shallow and the leases are small, conditions favorable to the existence of the small independent operator and to the drilling of many wildcat wells. As a result of the wildcatting done in 1929, another county—Foard—was added to the list of producing counties in north central Texas, and a large number of new pools were opened.

The most important event of 1929 in the east and south central Texas fields, including the Balcones fault area, was the discovery of the Van pool in Van Zandt County. This pool, located on a large well-defined structure, assumed major importance from the first. The total output from the Van pool in 1929 was only 144,000 barrels, as the discovery well was not brought in until the middle of October. Nearly all the acreage in the Van pool is controlled by one company, the remainder being controlled by several companies. A unit plan of operation was put into effect whereby all the operating was done by the principal company and all the companies shared profits and expenses according to their acreage holdings.

The total production from the east and south central fields of Texas amounted to 27,368,000 barrels in 1929, compared with 16,123,000 barrels in 1928. The major part of the new production came from the Bruner or Salt Flat field of Caldwell and Guadalupe Counties. This field produced 13,286,000 barrels in 1929, compared with about 400,000 barrels in 1928. In July, 1929, the Darst Creek field of Guadalupe County was discovered. This discovery proved to be very important, although the output in 1929 was only 243,000 barrels. The Darst Creek field is similar to Luling and Salt Flat; that is, it is a shoe-string type of pool and produces from the Edwards lime. The wells are not deep and can be drilled quickly, resulting in the rapid development of the Salt Flat field. Activity at Darst Creek was retarded, however, by a proration agreement. Production in the older fields, such as Mexia, Powell, and Luling, declined steadily in 1929. The Boggy Creek field, located on a salt dome in Anderson and Cherokee Counties, showed a material gain in output in 1929, but the field as a whole was somewhat of a disappointment.

The discovery of the Van field in east Texas caused a wholesale invasion of that country by geologists and geophysicists. The blasting and core drilling that ensued undoubtedly yielded something of value, but the majority of the test wells were not begun until 1930. A few deep tests, with the Trinity sand as the objective, were drilled in the area in 1929, but the results were practically nil.

Production from the Panhandle district of Texas, which had declined materially in 1928, increased in 1929, even though it was curtailed during the last four months of the year. The production of the Panhandle in 1929 amounted to 30,632,000 barrels, compared with 25,286,000 barrels in 1928 and 40,253,000 barrels in 1927, the peak year. The most active spots in the Panhandle in 1929 were the Bowers, Finley, and Le Fors pools, all in Gray County. As the result of the rapid completion of wells of high initial production in these pools in mid year, production quickly exceeded demand, and a curtailment agreement was reached which prevented further gains in output. Compared with Gray County, discoveries of oil in other parts of the Panhandle were not important, although drilling for gas was attended by the usual success.

Production of the west Texas fields amounted to 133,328,000 barrels in 1929, compared with 123,540,000 barrels in 1928. Included in these figures is all the production from the area west of Jones, Runnels, and Menard Counties and south of the Panhandle.

Two pools dominated production in west Texas in 1929—Hendricks and Yates; in 1928 Hendricks only was of paramount importance.

The Hendricks field of Winkler County was operated under a proration agreement most of the year; the total output declined from 62,045,000 barrels in 1928 to 50,179,000 barrels in 1929. The field suffered greatly from water encroachment during 1929 and toward the end of the year was hardly able to produce its allowance under the proration agreement.

The Yates field was operated under a strict proration agreement all the year; its allowance, however, was raised above the amount permitted in 1928 and the total output of the field rose from 22,429,000 barrels in 1928 to 41,905,000 barrels in 1929. The daily potential production of the Yates field was increased steadily and at the end of 1929 was rated as greater than the actual daily production of the entire United States. As pointed out by a number of authorities, the potential production in the Yates field greatly exaggerates what the field would do in a sustained test as the initial production of the wells is calculated from an open-gage flow of very short duration. For example, the prize well in the Yates pool is reported to have produced 4,805.22 barrels of oil in 34 minutes, or at the rate of 203,000 barrels per day—at that time a record—but it is probable that on a full 24-hour test the output would have been much less.

The Chalk and Roberts-Settles pools in Howard and Glasscock Counties were actively developed in 1929, when they produced 15,633,000 barrels, an increase of nearly 10,000,000 barrels over 1928. This increase was recorded even though a proration agreement was in effect during part of the year. The Crane-Upton district declined steadily in production in 1929.

The production of the Big Lake field of Reagan County amounted to 6,460,000 barrels in 1929, a small decline from 1928. The discovery well of the deep zone at Big Lake was discovered late in 1928 and throughout 1929 showed a consistent gain in output. The yield from this well in 1929 almost compensated for the decline of the old wells in the shallower formation. Two other wells were completed in the deep zone in the Big Lake field in 1929, but neither had developed into a large producer before the close of the year.

Wildcatting was active over west Texas in 1929, but although a number of oil and gas shows were discovered none appeared to have major potentialities as the year closed. The most important new pools discovered were the Taylor-Link and Pecos Valley fields in Pecos County and the Penn pool in Ector County. The Rowan and Tong pool in Pecos County was ushered in by what promised to be a large producer; this later proved to be a freak well.

Production in the southwest Texas fields amounted to 3,850,000 barrels in 1929, compared with 3,276,000 barrels in 1928. No large, outstanding fields were developed in southwest Texas in 1929, and it is difficult to assign specific causes for the material gain in production during the year. However, the shallow depth of the producing horizons is conducive to the completion of a great number of wells, which more than compensates for the natural decline of the fields. Discoveries in southwest Texas in 1929 which bore promise of developing into future fields of importance were Driscoll, Duval County; Escobar, Zapata County; Palo Blanco, Brooks County; and a field near Roma, Starr County. The discovery of the field near Roma is noteworthy because the production is the first from Starr County and marks the most southerly point at which oil has been discovered in the United States. Wildcatting was active, and several important oil and gas shows were obtained in Bee and Goliad Counties on the northwest edge of the Texas Gulf coast area.

From the standpoint of production and new discoveries, the Texas Gulf coast area in 1929 experienced its most successful year. The total production amounted to 49,652,000 barrels, or about 10,000,000 barrels more than in 1928. The search by geophysical methods for new fields was more extensive than ever before, and a number of new salt domes were discovered.

The largest factor in the increased output in the Texas Gulf coast district in 1929 was the increase in importance of Barbers Hill. Before the rich deep sands at Barbers Hill were discovered in October, 1928, the production from that field was negligible. However, it came into its own in 1929 and produced 4,552,000 barrels of oil, as compared with only a few thousand barrels in 1928.

Production in the Spindletop field declined materially in 1929, but the field retained first place in the Gulf coast area and its total output of 10,037,000 barrels exceeded the combined output of the fields ranking second and third. Material gains in output were recorded in the Sugarland and Raccoon Bend fields. These fields are both largely controlled by one company, which has developed them according to the latest engineering practice, including repressuring with residue gas.

One of the most active fields in the Texas Gulf coast area in 1929 was Refugio in Refugio County. This field differs from the majority of the Gulf coast fields in that no well has been drilled into salt. Once considered solely as a gas field, the Refugio field has surprised many by developing into an important oil field with several sands and favorable possibilities for deeper producing horizons. A large part of the Refugio field lies in or adjacent to the town of Refugio, and most of the leases are town lots or small irregular pieces. This situation led to an active drilling campaign, and more wells were drilled at Refugio in 1929 than in any other coastal field.

Among the new discoveries in the Texas Gulf coast area in 1929 were Lost Lake, Port Neches, Hankamer, Esperson, and Mykawa. Of these only the first two produced substantial amounts of oil in 1929.

Petroleum produced in Texas, 1920–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

District	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Gulf coast (salt-dome pools)										
Barbers Hill	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	4, 552
Batson	527	495	434	403	464	432	456	462	550	444
Big Creek	------	------	(2)	(2)	293	310	520	1, 243	811	1, 496
Blue Ridge	92	326	349	287	278	313	486	1, 210	2, 205	1, 194
Boling	------	------	------	------	------	40	1, 175	753	814	580
Damon Mound	379	666	754	628	520	416	341	312	291	224
Dayton	17	40	29	35	36	20	(2)	(2)	(2)	214
Fannette	------	------	------	------	------	------	------	------	(2)	292
Goose Creek	[1]4, 476	[1]4, 640	[1]4, 766	[1]6, 026	[1]3, 967	[1]3, 464	[1]3, 501	[1]3, 102	[1]2, 726	2, 154
High Island	------	------	------	------	------	121	60	96	163	449
Hull	3, 909	8, 150	6, 546	7, 300	7, 074	6, 944	7, 058	5, 685	4, 055	3, 376
Humble	3, 607	3, 004	2, 284	2, 275	2, 224	1, 864	1, 568	1, 485	1, 242	2, 990
Kingsville	------	------	------	------	------	------	------	146	153	120
Lost Lake	------	------	------	------	------	------	------	------	------	99
Markham	57	49	35	21	66	41	51	109	112	133
Moore	------	------	------	------	------	------	75	22	44	44
Nash	------	------	------	------	------	------	207	395	491	193
Orange	------	470	5, 345	4, 649	3, 958	4, 816	3, 458	1, 803	1, 415	1, 006
Piedras Pintas	------	------	------	------	------	17	93	(2)	------	------
Pierce Junction	------	1, 239	1, 020	313	154	265	948	2, 954	3, 899	5, 160
Port Neches	------	------	------	------	------	------	------	------	------	242
Raccoon Bend	------	------	------	------	------	------	------	1	98	2, 084
Refugio	------	------	------	------	------	------	------	------	(2)	1, 990
Saratoga	849	1, 129	713	626	543	514	482	413	343	333
Sourlake	2, 024	1, 802	1, 675	1, 906	1, 588	1, 444	2. 004	1, 593	1, 185	946
South Liberty	------	------	------	------	------	4, 416	1, 992	1, 084	1, 398	2, 137
Spindletop	322	344	289	326	359	412	13, 441	20, 751	14, 150	10, 037
Sugarland	------	------	------	------	------	------	------	------	390	3, 948
West Columbia	9, 459	12, 081	11, 126	5, 994	4, 536	4, 031	3, 197	3, 291	2, 800	2, 298
Other	17	6	5	32	22	5	[3] 22	[4] 94	[5] 301	[6] 917
Total Gulf coast	25. 735	34, 441	35, 370	30, 821	26, 082	29, 885	41, 135	[7] 47, 004	[7] 39, 636	49, 652
Rest of State										
East and south central Texas:										
Boggy Creek	------	------	------	------	------	------	------	15	331	1, 120
Calliham	------	------	------	------	187	98	52	29	24	20
Darst Creek	------	------	------	------	------	------	------	------	------	243
Luling	------	------	------	2, 248	11, 134	8, 979	7, 699	6, 169	[8] 5, 443	4, 948
Lytton Springs	------	------	------	------	------	2, 603	1, 783	784	846	600
Mexia [9]	297	6, 137	34, 790	50, 827	49, 272	42, 353	20, 494	12, 417	8, 353	5, 969
Salt Flat (Bruner)	------	------	------	------	------	------	------	------	(8)	13, 286
Somerset-Medina	162	324	672	1, 030	1, 109	873	791	767	738	659
Thrall-Minerva-Rockdale	60	52	37	247	235	255	535	508	337	251
Van	------	------	------	------	------	------	------	------	------	144
Other	51	48	35	38	59	58	36	[7] 43	[7] 51	128
Total east and south central Texas	570	6, 561	35, 534	54, 390	61, 996	55, 219	31, 390	[7] 20, 732	[7] 16, 123	27, 368
North central Texas [10]	70, 563	65, 164	47, 037	43, 896	42, 487	46, 013	49, 932	54, 806	49, 459	52, 046
Panhandle [11]	------	------	------	------	272	1, 132	25, 551	40, 253	25, 286	30, 632
Southwest Texas [12]	------	------	733	1, 786	2, 215	2, 688	4, 150	3, 056	3, 276	3, 850

[1] Barbers Hill included with Goose Creek prior to 1929.
[2] Included under "Other."
[3] Brenham and Dayton.
[4] Bernard, Brenham, Dayton, and Piedras Pintas.
[5] Bernard, Brenham, Dayton, Fannette, and Refugio.
[6] Allen, Bernard, Esperson, Hankamer, and Mykawa districts and Washington County.
[7] Revised figures.
[8] Salt Flat included with Luling.
[9] Includes Corsicana, Nigger Creek, Powell, Richland, Wortham, and smaller fields in Falls, Freestone, Limestone, and Navarro Counties.
[10] Includes the districts in and between Wilbarger, Wichita, Clay, Montague, and Cooke Counties on the north and Runnels, Coleman, Brown, and Comanche Counties on the south.
[11] Carson, Gray, Hutchinson, Moore, Potter, and Wheeler Counties.
[12] Includes fields in Jim Hogg, Webb, and Zapata Counties and Duval County except salt-dome field at Piedras Pintas.

Petroleum produced in Texas, 1920–1929, by districts—Continued

[Thousands of barrels of 42 U. S. gallons]

District	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Rest of State—Continued.										
West Texas:										
Big Lake	------	------	------	12	1,056	8,900	10,937	8,986	6,753	6,460
Chalk-Roberts	------	------	------	------	------	------	(13)	1,072	[14] 5,736	[14] 15,633
Crane-Upton	------	------	------	------	------	------	2,204	30,607	25,529	16,852
Fisher	------	------	------	------	------	------	------	------	(2)	418
Hendricks	------	------	------	------	------	------	------	3,641	62,045	50,179
Taylor-Link	------	------	------	------	------	------	------	------	------	461
Ward	------	------	------	------	------	------	------	------	------	453
Westbrook	------	------	10	118	414	811	[13] 1,372	1,365	(14)	(14)
World	------	------	------	------	------	------	237	516	796	673
Yates	------	------	------	------	------	------	(2)	5,329	22,429	41,905
Other	------	------	------	------	------	------	8	22	252	294
Total West Texas	------	------	10	130	1,470	9,711	14,758	51,538	123,540	133,328
Total Rest of State	71,133	71,725	83,314	100,202	108,440	114,763	125,781	[7] 170,385	[7] 217,684	247,224
Grand total	96,868	106,166	118,684	131,023	134,522	144,648	166,916	217,389	257,320	296,876

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[2] Included under "Other."

[7] Revised figures.

[13] Westbrook includes Chalk and other small fields in Howard and Mitchell Counties.

[14] Chalk-Roberts includes Westbrook.

Petroleum produced in coastal Texas salt-dome pools, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Batson	40	37	40	36	40	38	40	38	36	39	37	37	458	92	550
Big Creek	59	59	55	42	45	42	92	96	91	72	67	72	792	19	811
Blue Ridge	122	112	183	199	234	163	210	238	231	198	164	140	2,194	11	2,205
Boling	63	63	77	64	89	64	61	56	46	50	61	100	794	20	814
Damon Mound	21	24	21	24	22	24	22	19	16	25	23	21	262	29	291
Goose Creek[1]	241	218	234	224	227	209	212	207	192	274	191	249	2,678	48	2,726
High Island	-----	8	6	3	5	12	12	12	12	13	21	43	147	16	163
Hull	345	317	333	313	367	331	311	321	343	372	323	312	3,988	67	4,055
Humble	104	98	106	97	97	91	95	104	102	119	91	102	1,206	36	1,242
Kingsville	36	20	16	11	9	10	8	8	9	9	9	9	154	−1	153
Markham	6	5	9	9	7	10	8	14	8	11	10	11	108	4	112
Moore	6	4	2	1	1	1	-----	12	7	3	2	2	41	3	44
Orange	129	118	124	137	132	130	114	106	100	106	104	96	1,396	19	1,415
Pierce Junction	278	246	305	345	423	329	343	331	293	350	292	342	3,877	22	3,899
Raccoon Bend	-----	-----	-----	-----	-----	-----	-----	-----	5	24	25	30	84	14	98
Saratoga	19	19	19	18	70	45	35	30	30	51	34	35	405	−62	343
Sourlake	103	94	104	97	101	100	101	98	94	95	87	88	1,162	23	1,185
South Liberty	63	63	96	117	126	112	121	112	105	108	151	191	1,365	33	1,398
Spindletop	1,306	1,065	1,175	1,108	1,251	1,226	1,190	1,195	1,170	1,166	1,143	1,154	14,149	1	14,150
Sugarland	-----	-----	-----	9	7	7	9	5	12	61	133	143	386	4	390
West Columbia[2]	289	271	291	284	277	262	269	268	231	249	249	227	3,167	124	3,291
Other[3]	10	9	9	13	15	11	62	41	29	35	34	31	299	2	301
	3,240	2,850	3,205	3,151	3,545	3,217	3,315	3,311	[4]3,162	[4]3,430	[4]3,251	[4]3,435	[4]39,112	[4]524	[4]39,636
1929															
Barbers Hill	57	161	201	436	344	254	250	505	603	623	617	489	4,540	12	4,552
Batson	37	33	38	38	38	37	37	39	38	36	36	36	443	1	444
Big Creek	138	116	116	84	65	115	117	117	135	149	132	194	1,478	18	1,496
Blue Ridge	139	114	110	110	110	133	91	84	83	81	66	70	1,191	3	1,194
Boling	65	54	58	57	52	45	44	42	36	42	39	35	569	11	580
Damon Mound	23	19	20	22	20	18	20	16	16	13	13	13	213	11	224
Dayton	15	12	14	13	13	12	12	19	15	12	12	57	206	8	214
Fannette	5	22	16	15	9	6	-----	-----	1	70	63	47	254	38	292
Goose Creek	185	191	195	181	178	159	192	183	170	180	159	166	2,139	15	2,154
High Island	31	33	36	35	40	30	41	40	24	43	42	36	431	18	449
Hull	302	269	313	267	264	261	236	256	240	313	291	327	3,339	37	3,376
Humble	140	130	163	239	236	170	194	269	220	353	461	382	2,957	33	2,990
Kingsville	9	6	9	6	7	5	7	22	17	15	10	4	117	3	120
Lost Lake	-----	-----	-----	-----	-----	-----	-----	-----	25	13	2	35	75	24	99
Markham	11	11	12	12	11	12	9	11	10	11	10	10	130	3	133
Moore	2	2	2	12	4	5	3	3	3	3	3	2	44	------	44
Orange	93	74	88	86	94	81	83	82	76	80	76	81	994	12	1,006
Pierce Junction	357	327	388	514	575	530	534	438	396	345	349	392	5,145	15	5,160
Port Neches	-----	-----	-----	-----	18	12	16	16	13	46	37	75	233	9	242
Raccoon Bend	59	54	61	90	141	171	212	259	240	254	261	260	2,062	22	2,084
Refugio	20	32	26	66	57	87	107	110	160	324	440	529	1,958	32	1,990
Saratoga	25	22	27	25	28	28	21	28	29	30	31	29	323	10	333
Sourlake	82	75	82	76	83	76	80	82	78	74	72	76	936	10	946
South Liberty	263	161	179	147	182	154	157	152	170	179	162	188	2,094	43	2,137
Spindletop	1,057	943	1,034	978	876	830	861	786	709	738	630	593	10,035	2	10,037
Sugarland	219	207	283	344	348	352	391	358	335	355	366	375	3,933	15	3,948
West Columbia[2]	227	202	225	195	201	184	193	192	185	199	183	198	2,384	107	2,491
Other[5]	17	49	85	85	81	51	92	138	68	71	59	16	812	105	917
	3,578	3,319	3,781	4,133	4,075	3,818	4,000	4,247	4,095	4,652	4,622	4,715	49,035	617	49,652

[1] Includes Barbers Hill.
[2] Includes 491,000 barrels produced in Nash in 1928 and 193,000 barrels in 1929.
[3] Bernard, Brenham, Dayton, Fannette, and Refugio.
[4] Revised figures.
[5] Allen, Bernard, Esperson, Hankamer, and Mykawa districts and Washington County.

Petroleum produced in Texas (exclusive of salt-dome fields), 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
East and south central Texas:															
Boggy Creek	------	------	------	------	5	2	10	15	21	48	51	166	318	13	331
Calliham	2	2	3	2	3	2	2	1	2	2	1	2	24	------	24
Luling [1]	455	429	453	427	452	427	431	419	406	415	422	598	5,334	109	5,443
Lytton Springs	66	63	79	76	77	70	72	68	70	71	67	61	840	6	846
Mexia	950	714	763	701	717	660	664	674	646	674	618	615	8,396	−43	8,353
Somerset-Medina	59	62	64	63	63	61	62	62	59	61	58	58	732	6	738
Thrall-Minerva-Rockdale	34	31	32	30	30	28	27	27	25	25	24	24	337	------	337
Other	3	3	5	3	4	3	4	3	[2] 4	[2] 6	[2] 5	[2] 6	[2] 49	[2] 2	[2] 51
North central Texas	1,569	1,304	1,399	1,302	1,351	1,253	1,272	1,269	[2] 1,233	[2] 1,302	[2] 1,246	[2] 1,530	[2] 16,030	[2] 93	[2] 16,123
Panhandle	3,805	3,609	3,907	3,845	4,026	4,042	4,430	4,614	4,335	4,440	4,211	4,214	49,478	−19	49,459
Southwest Texas	2,382	2,220	2,314	2,082	2,049	2,019	1,988	2,158	2,056	2,257	1,987	1,907	25,419	−133	25,286
	195	174	184	201	202	236	266	266	301	424	397	400	3,246	30	3,276
West Texas:															
Big Lake	682	567	603	567	549	516	555	550	536	543	494	533	6,695	58	6,753
Chalk-Roberts [3]	294	209	216	214	214	214	231	349	664	926	1,009	1,151	5,691	45	5,736
Crane-Upton	3,105	2,737	2,569	2,257	2,286	1,971	2,125	1,892	1,723	1,712	1,571	1,497	25,445	84	25,529
Hendricks	2,467	3,274	5,311	6,739	5,956	5,235	6,190	6,047	5,557	5,276	4,856	5,199	62,107	−62	62,045
World	58	52	52	64	58	56	77	90	72	77	70	68	794	2	796
Yates	1,496	1,412	1,507	1,567	1,650	1,462	2,069	2,239	2,164	2,342	2,202	2,300	22,410	19	22,429
Other	5	9	9	6	9	21	24	30	32	35	31	38	249	3	252
	8,107	8,260	10,267	11,414	10,722	9,475	11,271	11,197	10,748	10,911	10,233	10,786	123,391	149	123,540
	16,058	15,567	18,071	18,844	18,350	17,025	19,227	19,504	[2] 18,673	[2] 19,334	[2] 18,074	[2] 18,837	[2] 217,564	[2] 120	[2] 217,684

1929															
East and south central Texas:															
Boggy Creek	82	94	107	93	84	80	92	84	84	101	98	121	1, 120		1, 120
Calliham	2	1	3	3	3	1	1	1	2	1	1	1	20		20
Darst Creek								18	55	60	38	66	237	6	243
Luling	489	457	450	426	420	390	399	383	360	372	348	344	4, 838	110	4, 948
Lytton Springs	60	54	54	52	51	50	52	49	48	48	47	41	606	−6	600
Mexia	574	505	544	537	526	486	502	490	457	464	440	440	5, 965	4	5, 969
Salt Flat (Bruner)	276	613	997	1, 194	1, 382	1, 474	1, 536	1, 482	1, 238	1, 130	963	901	13, 186	100	13, 286
Somerset-Medina	58	53	59	56	60	48	55	55	58	55	52	49	658	1	659
Thrall-Minerva-Rockdale	24	18	25	22	21	21	21	20	19	20	20	20	251		251
Van											13	122	135	9	144
Other	6	9	8	12	13	10	13	10	11	11	10	8	121	7	128
	1, 571	1, 804	2, 247	2, 395	2, 560	2, 560	2, 671	2, 592	2, 332	2, 262	2, 030	2, 113	27, 137	231	27, 368
North central Texas	4, 325	3, 805	4, 179	4, 159	4, 277	4, 240	4, 678	4, 657	4, 471	4, 603	4, 292	4, 494	52, 180	−134	52, 046
Panhandle	1, 888	1, 580	1, 761	1, 747	2, 050	2, 406	2, 785	3, 830	3, 327	3, 169	2, 799	3, 027	30, 369	263	30, 632
Southwest Texas	389	331	370	335	344	317	319	308	290	289	263	290	3, 845	5	3, 850
West Texas:															
Big Lake	579	501	559	541	575	536	541	532	515	508	500	513	6, 400	60	6, 460
Chalk-Roberts [3]	1, 218	1, 273	1, 435	1, 402	1, 390	1, 351	1, 348	1, 235	1, 172	1, 235	1, 251	1, 198	15, 508	125	15, 633
Crane-Upton	1, 579	1, 441	1, 380	1, 269	1, 571	1, 480	1, 557	1, 606	1, 536	1, 574	1, 503	1, 463	17, 959	−1, 107	16, 852
Fisher	29	25	28	28	28	32	38	39	45	43	41	40	416	2	418
Hendricks	5, 338	4, 820	5, 213	4, 441	4, 521	4, 182	4, 242	3, 988	3, 648	3, 458	3, 082	2, 931	49, 864	315	50, 179
Taylor-Link								20	50	104	100	158	432	29	461
Ward				20	33	32	52	70	51	59	67	63	447	6	453
World	62	53	60	58	59	54	55	50	50	55	56	57	669	4	673
Yates	2, 344	2, 467	2, 780	2, 741	2, 997	3, 213	4, 373	4, 175	3, 986	4, 347	4, 179	4, 239	41, 841	64	41, 905
Other	14	14	20	18	23	19	24	29	31	29	33	39	293	1	294
	11, 163	10, 594	11, 475	10, 518	11, 197	10, 899	12, 230	11, 744	11, 084	11, 412	10, 812	10, 701	133, 829	−501	133, 328
	19, 336	18, 114	20, 032	19, 154	20, 428	20, 422	22, 683	23, 131	21, 504	21, 735	20, 196	20, 625	247, 360	−136	247. 224

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[1] Includes Salt Flat.

[2] Revised figures.

[3] Includes Westbrook.

West Virginia.—No outstanding discoveries were recorded in West Virginia in 1929, but the total output of petroleum—5,574,000 barrels—was only slightly under the 1928 total. Production was sustained through a material increase in the number of oil wells completed—from 200 in 1928 to 350 in 1929.

Petroleum produced in West Virginia, 1925-1929, by months

[Thousands of barrels of 42 U. S. gallons]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year
1925	475	446	488	491	477	511	501	476	485	503	436	474	5,763
1926	449	440	497	493	490	510	518	504	518	519	489	519	5,946
1927	475	474	550	509	518	517	496	523	505	507	484	465	6,023
1928	460	460	502	451	519	471	481	489	444	506	444	434	5,661
1929	458	403	466	465	492	452	482	477	453	511	454	461	5,574

Wyoming.—The steady decline of production in Wyoming, which began in 1924, was continued in 1929 and the total output amounted to 19,314,000 barrels, compared with 21,461,000 barrels in 1928. The decline resulted primarily from a decrease in the Salt Creek field; the production of the State, exclusive of Salt Creek, increased in 1929. Development work in the Oregon Basin field of Park County was curtailed in 1929, but the production increased materially over that in 1928, and the field supplanted Lost Soldier and ranked second among the producing pools of the State. Completions in the majority of the fields in Wyoming in 1929 were below the 1928 totals, but some attention was paid to exploring the deeper horizons. In the Salt Creek field the wells which were bottomed in the Lakota sand and shut in during most of 1928 were opened, and some of the wells in the underlying Sundance sand were drawn on. The discovery of oil in the Madison lime of Mississippian age in the Frannie pool, although the oil obtained was of low gravity, was regarded as important.

Petroleum produced in Wyoming, 1920–1929, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Big Muddy	Byron-Greybull-Torchlight	Elk Basin	Ferris	Grass Creek	Hamilton Dome-Warm Springs	La Barge	Lance Creek	Lander-Dallas-Derby Dome	Lost Soldier	Mule Creek
1920	2,083	69	732	(1)	1,573	57	--------	353	84	[1] 135	182
1921	1,927	80	681	(1)	1,435	67	--------	346	119	[1] 524	68
1922	1,506	70	652	(1)	1,784	111	--------	282	149	[1] 751	168
1923	1,527	57	634	(1)	1,589	216	--------	363	137	[1] 1,551	--------
1924	1,272	33	409	42	1,113	239	--------	786	133	1,733	178
1925	1,223	30	314	33	1,240	264	--------	360	152	1,713	129
1926	1,215	(2)	273	(1)	1,025	319	70	540	165	[1] 2,059	--------
1927	1,072	28	337	(1)	974	313	341	269	246	[1] 1,341	188
1928	962	25	360	(1)	871	298	490	217	247	[1] 1,442	142
1929	802	26	265	(1)	778	355	805	87	209	[1] 1,311	141

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[1] Ferris included with Lost Soldier.

[2] Included under "Other."

Petroleum produced in Wyoming, 1920–1929, by districts—Continued

[Thousands of barrels 42 U. S. gallons]

Year	Notches	Oregon Basin	Osage	Pilot Butte	Poison Spider-South Casper	Rex Lake	Rock Creek	Salt Creek	Teapot	Other	Total
1920	--------	--------	16	69	--------	--------	1,370	10,090	--------	18	16,831
1921	--------	--------	176	46	--------	--------	1,681	12,172	--------	11	19,333
1922	--------	--------	182	38	--------	--------	1,728	19,248	37	9	26,715
1923	61	--------	178	29	(2)	--------	1,429	35,770	1,156	88	44,785
1924	39	--------	146	29	229	41	1,181	30,874	1,004	17	39,498
1925	35	--------	109	25	297	20	1,087	21,445	632	65	29,173
1926	34	--------	113	20	[3]376	53	1,029	18,010	426	49	25,776
1927	24	--------	107	17	247	44	982	14,399	314	64	21,307
1928	--------	882	133	19	327	18	928	14,023	--------	77	21,461
1929	--------	1,540	166	18	[4]446	36	842	11,377	--------	110	19,314

[2] Included under "Other."
[3] Includes Iron Creek and Simpson Ridge.
[4] Includes Simpson Ridge.

Petroleum produced in Wyoming, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1—Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1928															
Big Muddy	83	78	84	80	84	79	80	86	81	79	75	73	962	-----	962
Elk Basin	28	31	32	32	32	34	33	29	27	30	27	25	360	-----	360
Grass Creek	75	72	74	73	77	74	73	74	68	70	69	69	868	3	871
Hamilton Dome	31	30	48	30	30	40	35	30	-----	-----	9	13	296	2	298
La Barge	36	39	26	25	25	20	12	12	53	86	74	76	484	6	490
Lance Creek	18	19	22	21	22	18	18	16	14	13	11	12	204	13	217
Lander-Dallas	30	20	22	23	22	20	21	19	18	17	13	16	241	6	247
Lost Soldier-Ferris	33	29	236	149	201	130	136	143	122	120	117	110	1,526	—84	1,442
Mule Creek	-----	-----	-----	-----	-----	19	29	25	19	20	18	13	143	—1	142
Oregon Basin	-----	15	26	10	31	40	85	137	120	174	110	90	838	44	882
Osage	11	11	10	11	9	8	11	13	10	12	11	11	128	5	133
Poison Spider-South Casper	12	25	26	37	17	17	17	28	27	28	33	28	295	32	327
Rex Lake	-----	-----	-----	-----	-----	-----	-----	-----	4	5	5	4	18	-----	18
Rock Creek	76	73	78	74	79	78	85	87	79	79	75	68	931	—3	928
Salt Creek	1,298	1,096	1,187	1,155	1,267	1,253	1,196	1,197	1,154	1,220	1,070	1,010	14,103	—80	14,023
Other	2	2	5	4	9	5	8	12	15	8	12	15	97	24	121
	1,733	1,540	1,876	1,724	1,905	1,835	1,839	1,908	1,811	1,961	1,729	1,633	21,494	—33	21,461
1929															
Big Muddy	70	60	74	68	71	69	71	67	66	65	61	62	804	−2	802
Elk Basin	23	19	23	23	24	23	22	24	22	21	20	21	265	-----	265
Grass Creek	68	60	66	67	68	66	68	69	62	64	61	62	781	−3	778
Hamilton Dome	25	14	30	34	36	37	30	31	32	32	33	20	354	1	355
La Barge	68	56	64	63	67	63	68	72	68	73	71	70	803	2	805
Lance Creek	9	8	9	8	8	7	7	6	6	6	6	6	86	1	87
Lander-Dallas	20	14	22	12	19	15	17	19	18	18	16	20	210	−1	209
Lost Soldier-Ferris	112	91	106	103	101	108	129	124	120	124	96	100	1,314	−3	1,311
Mule Creek	-----	-----	-----	-----	5	31	21	18	16	19	15	12	137	4	141
Oregon Basin	105	85	89	76	119	149	174	178	160	128	130	134	1,527	13	1,540
Osage	11	11	14	14	12	13	14	18	13	14	14	18	166	-----	166
Poison Spider-South Casper	39	32	37	26	28	37	34	40	39	37	37	38	424	22	446
Rex Lake	4	3	2	4	4	3	4	2	2	3	2	3	36	-----	36
Rock Creek	71	64	68	74	77	69	74	75	67	70	66	67	842	-----	842
Salt Creek	916	903	957	945	929	913	939	1,022	972	992	930	944	11,362	15	11,377
Other	5	2	1	2	4	4	12	12	10	7	19	35	113	41	154
	1,546	1,422	1,562	1,519	1,572	1,607	1,684	1,777	1,673	1,673	1,577	1,612	19,224	90	19,314

WORLD PRODUCTION

The world production of crude petroleum during 1929 reached a total of 1,485,829,000 barrels, an increase of 161,096,000 barrels, or 12.2 per cent, over 1928. Production outside the United States reached a total of 478,506,000 barrels, or 55,247,000 barrels more than in 1928. Domestic production increased 105,849,000 barrels. The rate of increase in domestic production did not quite equal that in the foreign oil-producing countries; consequently, the ratio of the United States' production to that of the world dropped from 68 per cent in 1928 to 67.8 per cent in 1929. Venezuela and Russia maintained their respective positions as the second and third largest producing countries (see fig. 13).

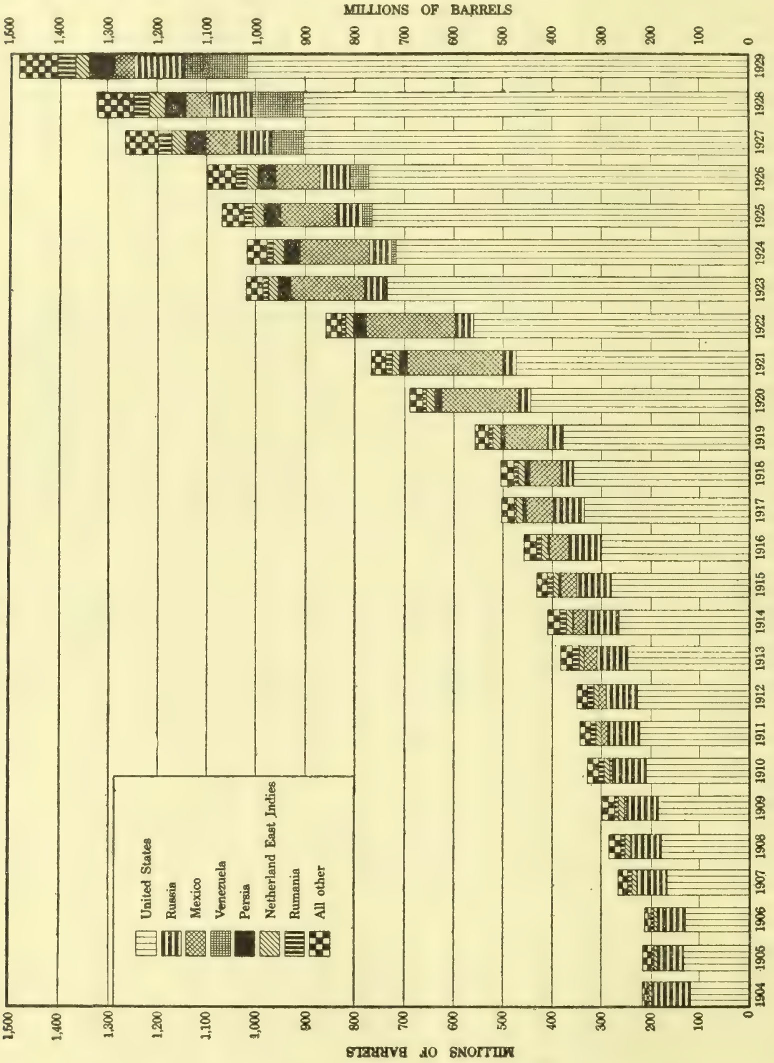

FIGURE 13.—World production of crude petroleum, 1904-1929, by countries

Venezuela.—Venezuela increased its production from 105,749,000 barrels in 1928 to 137,472,000 barrels in 1929 and retained second place among the nations by a wide margin. Production in the Lagunillas field increased approximately 17,000,000 barrels in 1929, and the field continued to rank first among the pools of the country. Production in La Rosa and Mene Grande fields, which ranked second and third, respectively, increased in 1929, but the increases were much less than that in Ambrosio, the field ranking fourth. The relative importance of the Maracaibo Basin in the oil production of Venezuela is illustrated by the fact that only about 500,000 barrels of the total was produced outside of the area adjacent to the lake.

Russia.—Production in the U. S. S. R. (Russia), the country ranking third, amounted to 99,507,000 barrels in 1929, an increase of nearly 15,000,000 barrels over 1928. Production in both the leading districts in Russia—Baku and Grozny—increased in 1929. These two areas produced 97 per cent of the total Russian output in 1929.

Mexico.—Production in Mexico continued to decline and amounted to 44,688,000 barrels in 1929, compared with 50,151,000 barrels in 1928. Production in Persia, which ranked just below Mexico in 1928, also declined in 1929, and Mexico retained fourth place among the producing nations. The decline in output in Mexico in 1929 occurred chiefly in the heavy-oil fields.

Other countries.—Through increased production in 1929, the Netherland East Indies, Rumania, Colombia, Peru, and Argentina retained their respective ranks, and British India remained the leading British producing country. Among the lesser producers, Canada and Russian Sakhalin reached, for the first time, an annual production of more than a million barrels.

World production of crude petroleum,

[Thousands of barrel

Year	Rumania	United States	Italy	Canada	Russia[1]	Poland (Galicia)	Japan and Taiwan	Germany	India	Netherland East Indies	Peru	Mexico	Argentina
1857-60	19	502	(3)	------	------	------	------	------	------	------	------	------	------
1861	17	2,114	(3)	------	------	------	------	------	------	------	------	------	------
1862	23	3,057	(3)	12	------	------	------	------	------	------	------	------	------
1863	28	2,611	(3)	83	41	------	------	------	------	------	------	------	------
1864	33	2,116	(3)	90	65	------	------	------	------	------	------	------	------
1865	39	2,498	2	110	67	------	------	------	------	------	------	------	------
1866	42	3,598	1	175	83	------	------	------	------	------	------	------	------
1867	51	3,347	1	190	120	------	------	------	------	------	------	------	------
1868	56	3,646	(3)	200	88	------	------	------	------	------	------	------	------
1869	59	4,215	(3)	220	202	------	------	------	------	------	------	------	------
1870	84	5,261	(3)	250	204	------	------	------	------	------	------	------	------
1871	90	5,205	(3)	270	165	------	------	------	------	------	------	------	------
1872	91	6,293	(3)	308	185	------	------	------	------	------	------	------	------
1873	104	9,894	(3)	365	475	------	------	------	------	------	------	------	------
1874	103	10,927	1	169	583	150	------	------	------	------	------	------	------
1875	108	8,788	1	220	697	158	5	------	------	------	------	------	------
1876	111	9,133	3	312	1,321	164	7	------	------	------	------	------	------
1877	108	13,350	3	312	1,801	170	10	------	------	------	------	------	------
1878	109	15,397	4	312	2,401	176	18	------	------	------	------	------	------
1879	110	19,914	3	575	2,761	215	23	------	------	------	------	------	------
1880	115	26,286	2	350	3,001	229	26	9	------	------	------	------	------
1881	122	27,661	1	275	3,601	287	17	29	------	------	------	------	------
1882	136	30,350	2	275	4,538	330	15	58	------	------	------	------	------
1883	139	23,450	2	250	6,002	365	20	27	------	------	------	------	------
1884	211	24,218	3	250	10,805	408	28	46	------	------	------	------	------
1885	193	21,859	2	250	13,925	465	30	41	------	------	------	------	------
1886	168	28,065	2	584	18,006	306	38	74	------	------	------	------	------
1887	182	28,283	1	526	18,368	344	29	74	------	------	------	------	------
1888	219	27,612	1	695	23,049	467	37	85	------	------	------	------	------
1889	298	35,164	1	705	24,609	515	53	68	94	------	------	------	------
1890	383	45,824	3	795	28,691	659	52	108	118	------	------	------	------
1891	488	54,293	8	755	34,573	631	53	109	190	------	------	------	------
1892	593	50,515	18	780	35,775	646	69	101	242	------	------	------	------
1893	535	48,431	19	798	40,457	693	106	100	299	600	------	------	------
1894	508	49,344	21	829	36,375	949	173	123	327	688	------	------	------
1895	576	52,892	26	726	46,140	1,453	170	121	372	1,216	------	------	------
1896	543	60,960	18	727	47,221	2,444	237	145	430	1,427	47	------	------
1897	571	60,476	14	710	54,399	2,226	262	166	546	2,552	71	------	------
1898	776	55,364	15	758	61,610	2,376	319	184	542	2,964	71	------	------
1899	1,426	57,071	16	808	65,955	2,314	539	192	941	1,796	89	------	------
1900	1,629	63,621	12	913	75,780	2,347	871	358	1,079	2,253	274	------	------
1901	1,678	69,389	16	757	85,168	3,251	1,117	314	1,431	4,014	275	10	------
1902	2,060	88,767	19	531	80,540	4,142	996	354	1,617	2,430	287	40	------
1903	2,763	100,461	18	487	75,591	5,235	1,209	446	2,510	5,770	278	75	------
1904	3,599	117,081	26	553	78,537	5,947	1,219	637	3,385	6,508	290	126	------
1905	4,421	134,717	44	634	54,960	5,766	1,347	561	4,137	7,850	373	251	------
1906	6,378	126,494	54	569	58,897	5,468	1,564	579	4,016	8,181	531	502	------
1907	8,118	166,095	60	789	61,851	8,456	1,718	757	4,344	9,983	751	1,005	(3)
1908	8,252	178,527	51	528	62,187	12,612	1,871	1,009	5,047	10,283	945	3,933	12
1909	9,327	183,171	42	421	65,970	14,933	1,887	1,019	6,677	11,042	1,411	2,714	18
1910	9,724	209,557	51	316	70,337	12,673	1,829	1,032	6,138	11,031	1,258	3,634	20
1911	11,108	220,449	75	291	66,184	10,519	1,737	1,017	6,451	12,173	1,465	12,553	13
1912	12,976	222,935	54	243	68,019	8,535	1,659	1,031	7,117	10,846	1,752	16,558	47
1913	13,555	248,446	47	228	62,834	7,818	1,940	857	7,930	11,172	2,071	25,696	131
1914	12,827	265,763	40	215	67,020	6,436	2,636	781	7,410	11,422	1,837	26,235	276
1915	12,030	281,104	44	215	68,548	5,352	2,928	703	8,202	11,920	2,579	32,911	513
1916	8,945	300,767	51	198	65,817	6,587	2,963	656	8,491	12,547	2,593	40,546	867
1917	3,721	335,316	41	214	63,072	6,228	2,861	642	8,079	13,180	2,577	55,293	1,218
1918	8,730	355,928	35	305	27,168	6,032	2,441	270	8,188	12,778	2,527	63,828	1,353
1919	6,618	378,367	35	241	31,752	6,096	2,238	265	8,736	15,508	2,628	87,073	1,331
1920	7,435	442,929	35	196	25,430	5,607	2,221	246	8,375	17,529	2,817	157,069	1,651
1921	8,368	472,183	32	188	28,968	5,167	2,233	274	8,734	16,958	3,699	193,398	2,036
1922	9,843	557,531	31	179	35,692	5,227	2,055	319	8,529	17,066	5,314	182,278	2,866
1923	10,867	732,407	34	170	39,147	5,402	1,804	346	8,406	19,870	5,699	149,585	3,400
1924	13,369	713,940	39	161	45,355	5,657	1,814	406	8,416	20,473	8,379	139,678	4,639
1925	16,650	763,743	61	332	52,448	5,960	1,915	541	8,274	21,422	9,232	115,515	6,336
1926	23,314	770,874	41	364	64,311	5,844	1,785	653	8,011	21,243	10,762	90,421	7,851
1927	26,368	901,129	47	477	77,018	5,342	1,789	663	8,032	27,459	10,127	64,121	8,630
1928	30,773	901,474	46	624	[5] 84,704	5,492	1,944	630	8,741	32,118	12,006	50,151	9,070
1929	34,758	1,007,323	44	1,117	[5] 99,507	4,988	2,010	704	8,747	39,279	13,422	44,688	9,391
	339,771	12,250,472	1,419	28,475	2,431,171	218,259	58,937	19,930	199,351	435,551	108,437	1,559,887	61,669

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[1] Exclusive of Sakhalin, which is shown separately.

[2] Estimated.

[3] Less than 1,000 barrels.

[4] Production in previous years credited to Germany.

1857–1929, by years and countries

of 42 U. S. gallons]

Trinidad	Egypt	Persia	Sarawak	Algeria	Ecuador	Venezuela	France	England	Czechoslovakia	Sakhalin (Russian)	Colombia	Iraq	Other countries[3]	Total	Percentage produced by United States
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	521	96
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2, 131	99
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3, 092	99
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2, 763	94
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2, 304	92
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2, 716	92
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3, 899	92
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3, 709	90
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3, 990	91
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4, 696	90
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5, 799	91
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5, 730	91
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6, 877	92
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10, 838	91
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11, 933	92
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	9, 977	88
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11, 051	83
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15, 754	85
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	18, 417	84
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	23, 601	84
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30, 018	88
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31, 993	86
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35, 704	85
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30, 255	78
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35, 969	67
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36, 765	59
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	47, 243	59
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	47, 807	59
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	52, 165	53
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	61, 507	57
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	76, 633	60
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	91, 100	60
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	88, 739	57
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	92, 038	53
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	89, 337	55
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	103, 692	51
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	114, 199	53
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	121, 993	50
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	124, 979	44
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	131, 147	44
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	149, 137	43
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	167, 440	41
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	26	181, 809	49
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36	194, 879	52
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40	217, 948	54
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	215, 091	63
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	213, 263	59
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	263, 957	63
(3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	285, 287	63
57	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	298, 709	61
143	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	327, 763	64
285	21	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	344, 361	64
437	214	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	352, 443	63
504	98	1, 857	141	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	385, 345	64
644	753	2, 910	318	1	-----	-----	-----	-----	-----	-----	-----	-----	20	407, 544	65
750	212	3, 616	392	4	-----	-----	-----	-----	-----	-----	-----	-----	10	432, 033	65
929	404	4, 477	629	8	-----	-----	-----	-----	-----	-----	-----	-----	25	457, 500	66
1, 602	943	7, 147	542	9	57	120	-----	-----	-----	-----	-----	-----	29	502, 891	67
2, 082	1, 935	8, 623	504	7	[2] 60	333	[4] 363	-----	-----	-----	-----	-----	25	503, 515	71
1, 841	1, 517	10, 139	596	5	[2] 60	425	334	2	48	-----	-----	-----	20	555, 875	68
2, 083	1, 042	12, 230	1, 020	4	[2] 60	457	356	3	69	-----	-----	-----	20	688, 884	64
2, 354	1, 255	16, 673	1, 411	3	[2] 60	1, 433	389	3	94	2	67	-----	20	766, 002	62
2, 445	1, 188	22, 247	2, 849	9	[2] 60	2, 201	496	1	120	7	323	-----	22	858, 898	65
3, 051	1, 054	25, 230	3, 940	9	87	4, 201	494	1	74	9	425	-----	24	1, 015, 736	72
4, 057	1, 122	32, 373	4, 163	11	[2] 100	9, 042	497	2	76	80	445	-----	24	1, 014, 318	70
4, 387	1, 226	35, 038	4, 257	12	160	19, 687	459	3	158	87	1, 007	-----	23	1, 068, 933	71
4, 971	1, 188	35, 842	4, 942	9	214	36, 911	478	2	150	181	6, 444	-----	17	1, 096, 823	70
5, 380	1, 267	39, 688	4, 943	8	537	63, 134	504	2	112	440	15, 014	338	13	1, 262, 582	71
7, 684	1, 842	43, 461	[6] 5, 223	8	1, 084	105, 749	512	[7] 1	94	677	19, 897	713	15	1, 324, 733	68
8, 716	1, 868	42, 145	[6] 5, 290	20	1, 381	137, 472	535	-----	93	[5] 1, 134	20, 385	798	14	1, 485, 829	68
54, 402	19, 149	343, 696	41, 160	127	3, 920	381, 165	5, 417	20	1, 088	2, 617	64, 007	1, 849	663	18, 632, 609	66

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[5] Year ended Sept. 30.

[6] Includes a small production from Brunei.

[7] Actual figure 604 barrels.

World production of petroleum in 1929, by countries, compared with 1928

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1929				1928			
	Thousands of barrels of 42 U. S. gallons	Thousands of metric tons	Thousands of cubic meters	Percentage of total by volume	Thousands of barrels of 42 U. S. gallons	Thousands of metric tons	Thousands of cubic meters	Percentage of total by volume
United States	1,007,323	138,104	160,147	67.8	901,474	123,592	143,319	68.0
Venezuela	137,472	20,402	21,856	9.3	105,749	15,711	16,812	8.0
Russia[1][2]	99,507	13,659	15,820	6.7	84,704	11,634	13,467	6.4
Mexico	44,688	6,733	7,105	3.0	50,151	7,585	7,973	3.8
Persia	42,145	5,549	6,700	2.8	43,461	5,763	6,910	3.3
Netherland East Indies	39,279	5,239	6,245	2.6	32,118	4,308	5,106	2.4
Rumania	34,758	4,837	5,526	2.3	30,773	4,282	4,892	2.3
Colombia	20,385	2,911	3,241	1.4	19,897	2,841	3,163	1.5
Peru	13,422	1,777	2,133	1.0	12,006	1,592	1,909	.9
Argentina	9,391	1,365	1,493	.6	9,070	1,323	1,442	.7
India, British	8,747	1,228	1,391	.6	8,741	1,227	1,390	.7
Trinidad	8,716	1,217	1,386	.6	7,684	1,139	1,222	.6
British Borneo (Sarawak)[3]	5,290	762	841	.4	5,223	752	830	.4
Poland	4,988	675	793	.3	5,492	743	873	.4
Japan (including Taiwan)	2,010	279	320	.1	1,944	270	309	.1
Egypt	1,868	272	297	.1	1,842	268	293	.1
Ecuador	1,381	196	220	.1	1,084	154	172	.1
Sakhalin, Russian	[2] 1,134	[2] 168	[2] 180	.3	677	106	108	.3
Canada	1,117	137	178		624	78	99	
Iraq	798	116	127		713	95	113	
Germany	704	103	112		630	92	100	
France	535	77	85		512	74	81	
Czechoslovakia	93	14	15		94	14	15	
Italy	44	6	7		46	6	7	
Algeria	20	5	6		8	3	4	
Cuba	2				5			
England	--------				[4] 1			
Other countries[5]	12				10			
	1,485,829	205,831	236,224	100.0	1,324,733	183,652	210,609	100.0

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[1] Exclusive of Sakhalin, which is shown separately.

[2] Year ended Sept. 30.

[3] Includes a small production from Brunei.

[4] Actual figure 604 barrels.

[5] Estimated.

PRODUCTION OF PETROLEUM IN FOREIGN COUNTRIES IN 1929, BY FIELDS

Petroleum produced in certain foreign countries in 1929, by provinces, districts, or fields

[Compiled by L. M. Jones, of the Bureau of Mines]

	Barrels of 42 U. S. gallons	Metric tons
Argentina:		
Comodoro Rivadavia	8,161,325	1,200,531
Plaza Huincul	1,023,226	138,647
Other fields	206,834	25,425
	9,391,385	1,364,603
Canada:		
Alberta	988,675	119,333
New Brunswick	7,499	997
Ontario—		
Bothwell	23,236	3,176
Oil Springs	30,789	4,132
Petrolia and Enniskillen	56,284	7,840
Other fields	10,885	1,488
	121,194	16,636
	1,117,368	136,966
Colombia: Infantas	20,384,547	2,910,913
Ecuador: Santa Elena	1,381,436	196,164
Egypt:		
Abu-Durba	3,841	594
Hurghada	1,864,256	271,520
	1,868,097	272,114
France:		
Alsace—Pechelbronn	513,600	73,658
Herault—Gabian	21,400	2,875
	535,000	76,533
Germany:		
Hildesheim	76,773	11,216
Lüneburg	627,187	91,627
Other fields	82	12
	704,042	102,855

Petroleum produced in certain foreign countries in 1929, by provinces, districts, or fields—Continued

	Barrels of 42 U. S. gallons	Metric tons
Iraq:		
Baba-Gurgur	268,000	39,000
Naft Khana	530,000	77,000
	798,000	116,000
Italy:		
Abruzzi—Pescara	44,124	5,700
Emilia—		
Parma		
Piacenza		
Rome—Frosinone		
	44,124	5,700
Mexico:		
Heavy oil—		
Altamira	20,209,783	3,156,768
Ebano		
El Limón		
Pánuco—		
Cacalilao		
Other		
San Jerónimo		
Topila		
	20,209,783	3,156,768
Light oil—		
Alazán	24,478,096	3,576,250
Belén		
Cerro Viejo		
Chiconcillo and San Miguel		
Dos Bocas		
Filisola		
Furbero		
Jardín and Paso Real		
Mecatepec		
Potrero del Llano		
San Isidro		
Sarlat		
Tangüijo		
Tecuanapa		
Tepetate, Chinampa, Amatlán, and Zacamixtle		
Tierra Amarilla		
Tierra Blanca, Chapapote, and Alamo		
Tonalá		
Toteco and Cerro Azul		
	24,478,096	3,576,250
	44,687,879	6,733,018
Netherland East Indies:		
Borneo	20,164,256	2,792,930
Ceram	351,619	45,172
Java—		
Central Java	3,092,011	402,082
East Java	2,184,852	289,461
	5,276,863	691,543
Sumatra—		
Atjeh	1,763,965	221,076
Djambi	1,005,069	127,563
East coast	1,185,482	150,461
Palembang	9,531,998	1,209,798
	13,486,514	1,708,898
	39,279,252	5,238,543

	Barrels of 42 U. S. gallons	Metric tons
Peru:		
La Brea and Pariñas	10,821,120	1,433,225
Lobitos	1,389,650	183,549
Restín and Alto	1,148,758	151,742
Zorritos	62,803	8,242
	13,422,331	1,776,758
Poland:		
Drohobycz	4,106,905	555,663
Jaslo	545,973	73,611
Stanislaw	334,936	45,415
	4,987,814	674,689
Rumania:		
Bacau	556,865	77,493
Buzau	620,913	86,406
Dambovitza	9,298,030	1,293,909
Prahova	24,282,687	3,379,166
	34,758,495	4,836,974
Russia:[1] [2]		
Baku	63,129,217	8,765,512
Cheleken Island (Turkmenistan).	61,436	8,774
Emba-Ural	1,949,281	269,089
Ferghana (Uzbekistan)	162,075	23,147
Grozny	33,093,577	4,436,731
Kuban-Black Sea	1,111,323	156,019
	99,506,909	13,659,272
Sakhalin: Okha[2]	1,134,000	168,000
Venezuela:		
Falcón—		
Hombre Pintado	39,200	6,013
Las Palmas	16,300	2,500
Urumaco	88,200	13,530
	143,700	22,043
Monagas—		
Amana	9,500	1,495
Guanoco	360,000	56,664
Netick	3,500	551
Quiriquiri	48,800	7,681
	421,800	66,391
Zulia—		
Ambrosio	12,174,700	1,755,592
Concepción	25,100	3,396
El Mene	2,159,200	282,207
Lagunillas	78,493,600	11,821,136
La Paz	57,200	8,048
La Rosa	27,337,200	4,015,835
Mene Grande	15,927,700	2,323,851
Punta Benitez	483,000	68,730
Tarra	180,200	24,922
Totumo	68,600	9,803
	136,906,500	20,313,520
	137,472,000	20,401,954

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[1] Exclusive of Sakhalin, which is shown separately.

[2] Year ended Sept. 30.

IMPORTS AND EXPORTS

Imports, after increasing rapidly during 1928, declined slightly in 1929; 78,933,000 barrels was brought in, compared with 79,767,000 barrels in 1928. The 1929 imports were valued at $79,943,000, or practically a dollar per barrel. Imports from Mexico declined in 1929 for the seventh successive year and amounted to 12,663,000 barrels, or about one-tenth of the total for 1922, the peak year. The decline in imports from Mexico was nearly compensated for by increases from Venezuela and Colombia. Venezuela continued to be the chief source of the crude imported and in 1929 was credited with 50,653,000 barrels, or 64 per cent of the total. The refineries of the Atlantic coast continued to take the major part of the crude imported.

Exports of crude petroleum from the United States, including a few thousand barrels shipped to the noncontiguous Territories, amounted to 26,401,000 barrels in 1929, compared with 18,966,000 barrels in 1928. Canada continued to be the leading customer for crude oil, with Japan second. The major part of the exports to Canada in 1929 was delivered across the northern border by pipe line, although shipments by boat to the Vancouver refineries were also important.

Crude petroleum imported and exported, 1928 and 1929, by months

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year	
													Thousands of barrels	Value (thousands of dollars)
1928														
Imports:														
By countries—														
Colombia	1, 141	1, 499	1, 199	790	855	880	1, 271	807	1, 086	759	324	1, 227	11, 838	17, 210
Mexico	1, 465	963	1, 542	1, 204	1, 773	1, 704	1, 496	1, 366	1, 578	1, 240	1, 960	1, 293	17, 584	19, 400
Peru	271	-----	-----	157	-----	163	102	246	-----	120	165	-----	1, 224	2, 707
Venezuela[1]	3, 283	3, 574	3, 885	3, 397	4, 083	3, 727	4, 808	3, 601	4, 347	4, 227	3, 954	4, 091	46, 977	48, 644
Other countries	170	-----	219	113	55	79	201	121	128	357	505	196	2, 144	2, 512
	6, 330	6. 036	6, 845	5, 661	6, 766	6, 553	7, 878	6, 141	7, 139	6, 703	6, 908	6, 807	79, 767	90, 473
By ports of entry—														
Atlantic coast	5, 629	5, 671	6, 276	5, 273	6, 127	6, 253	7, 178	5, 174	5, 613	5, 613	5, 838	5, 769	70, 414	81, 443
Gulf coast	701	365	569	388	632	298	700	967	1, 511	1, 090	1, 065	1, 038	9, 324	8, 986
Mexican border	-----	-----	-----	-----	-----	-----	-----	-----	15	-----	-----	-----	15	17
Northern border	-----	-----	-----	-----	7	-----	-----	-----	-----	-----	5	-----	12	24
Pacific coast	-----	-----	-----	-----	-----	2	-----	-----	-----	-----	-----	-----	2	3
	6, 330	6, 036	6, 845	5, 661	6, 766	6, 553	7, 878	6, 141	7, 139	6, 703	6, 908	6, 807	79, 767	90, 473
Exports:														
By countries—														
Domestic crude oil—														
Canada	865	998	1, 298	931	1, 243	1, 463	1, 377	1, 724	1, 272	1, 632	1, 292	1, 336	15, 431	22, 235
Cuba	53	54	-----	145	-----	53	-----	53	53	54	63	-----	528	990
Germany	59	-----	-----	-----	-----	39	41	-----	-----	-----	-----	42	181	298
Japan	189	189	130	151	168	214	211	63	70	255	316	110	2. 066	2, 254
Mexico	26	2	27	50	27	27	1	2	2	3	4	4	175	171
New Zealand	-----	-----	-----	6	-----	-----	-----	-----	-----	-----	-----	-----	6	6
Spain	33	-----	44	-----	-----	-----	38	-----	34	-----	-----	37	186	278
United Kingdom	-----	-----	-----	-----	-----	-----	-----	22	-----	13	-----	-----	35	60
Other countries	-----	-----	30	20	55	83	1	19	71	58	16	-----	353	494
Foreign crude oil	-----	-----	1	-----	-----	-----	-----	-----	(2)	-----	-----	-----	1	2
	1, 225	1, 243	1, 530	1, 303	1, 493	1, 879	1, 669	1, 883	1, 502	2, 015	1, 691	1, 529	18, 962	26, 788

[1] Includes imports recorded by Bureau of Foreign and Domestic Commerce as from Netherland West Indies.

[2] Less than 500 barrels.

Crude petroleum imported and exported, 1928 and 1929, by months—Continued

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year: Thousands of barrels	The year: Value (thousands of dollars)
1928														
Exports—Continued.														
By ports—														
Atlantic coast	-----	-----	1	-----	-----	-----	116	13	-----	-----	-----	-----	130	207
Gulf coast	146	54	74	106	171	331	187	176	166	187	210	80	1, 888	3, 209
Mexican border	2	1	4	4	81	153	63	139	2	176	4	197	826	1, 026
Northern border	598	686	807	692	828	974	808	1, 186	839	1, 216	966	839	10, 439	16, 391
Pacific coast	479	502	644	501	413	421	495	369	495	436	511	413	5, 679	5, 955
	1, 225	1, 243	1, 530	1, 303	1, 493	1, 879	1, 669	1, 883	1, 502	2, 015	1, 691	1, 529	18, 962	26, 788
Excess of imports over exports	5, 105	4, 793	5, 315	4, 358	5, 273	4, 674	6, 209	4, 258	5, 637	4, 688	5, 217	5, 278	60, 805	63, 685
1929														
Imports:														
By countries—														
Colombia	1, 272	1, 378	888	1, 330	857	637	792	914	845	1, 591	420	1, 696	12, 620	18, 490
Mexico	784	529	586	1, 113	1, 281	1, 624	1, 234	1, 445	1, 604	1, 043	708	712	12, 663	11, 388
Peru	212	239	265	-----	166	-----	-----	286	-----	-----	166	120	1, 454	3, 233
Venezuela[1]	5, 622	4, 791	4, 923	5, 201	5, 138	4, 186	3, 973	3, 016	4, 394	3, 022	3, 151	3, 236	50, 653	44, 774
Other countries	185	79	128	184	110	144	123	139	110	110	109	122	1, 543	2, 058
	8, 075	7, 016	6, 790	7, 828	7, 552	6, 591	6, 122	5, 800	6, 953	5, 766	4, 554	5, 886	78, 933	79, 943
By ports of entry—														
Atlantic coast	7, 061	6, 057	5, 659	6, 433	6, 545	5, 471	5, 551	5, 333	5, 847	5, 376	4, 028	5, 453	68, 814	71, 022
Gulf coast	1, 014	958	1, 131	1, 395	1, 007	1, 086	557	467	1, 106	390	526	433	10, 070	8, 823
Northern border	-----	-----	-----	-----	-----	34	14	-----	-----	-----	-----	-----	48	97
Pacific coast	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	1
	8, 075	7, 016	6, 790	7, 828	7, 552	6, 591	6, 122	5, 800	6, 953	5, 766	4, 554	5, 886	78, 933	79, 943
Exports:														
By countries—														
Domestic crude oil—														
Canada	1, 506	1, 354	1, 249	1, 279	1, 728	2, 248	2, 872	1, 922	1, 782	2, 592	2, 223	1, 657	22, 412	32, 357
Cuba	106	-----	108	54	54	53	53	53	-----	54	108	58	701	1, 428
Germany	-----	-----	-----	-----	-----	33	-----	-----	-----	-----	-----	-----	33	44
Japan	350	162	127	390	132	210	190	187	67	222	214	225	2, 476	2, 911
Mexico	3	123	1	1	2	2	1	74	1	1	1	1	211	212
New Zealand	-----	-----	-----	-----	-----	-----	-----	-----	61	-----	-----	-----	61	52
Spain	7	-----	27	-----	-----	46	-----	-----	46	-----	22	-----	148	241
United Kingdom	-----	-----	57	-----	16	18	1	-----	-----	-----	-----	-----	92	140
Other countries	-----	39	31	-----	-----	-----	-----	-----	31	-----	11	148	260	415
	1, 972	1, 678	1, 600	1, 724	1, 932	2, 610	3, 117	2, 236	1, 988	2, 869	2, 579	2, 089	26, 394	37, 800
By ports—														
Atlantic coast	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	82	-----	82	219
Gulf coast	113	-----	162	54	136	388	206	210	202	128	212	206	2, 017	3, 512
Mexican border	90	2	1	1	408	291	931	325	350	696	306	75	3, 476	5, 010
Northern border	1, 065	900	1, 008	899	899	1, 140	1, 252	1, 092	1, 046	1, 314	1, 255	1, 042	12, 912	21, 280
Pacific coast	704	776	429	770	489	791	728	609	390	731	724	766	7, 907	7, 779
	1, 972	1, 678	1, 600	1, 724	1, 932	2, 610	3, 117	2, 236	1, 988	2, 869	2, 579	2, 089	26, 394	37, 800
Excess of imports over exports	6, 103	5, 338	5, 190	6, 104	5, 620	3, 981	3, 005	3, 564	4, 965	2, 897	1, 975	3, 797	52, 539	42, 143

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[1] Includes imports recorded by Bureau of Foreign and Domestic Commerce as from Netherland West Indies.

Crude petroleum imported, exported, and shipped to Territories, 1925–1929

[Barrels of 42 U. S. gallons]

Year	Imports		Exports (including foreign crude oil)		Shipments from United States to Territories				Total of exports and shipments to Territories
					Alaska		Hawaii		
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value	Barrels
1925	61,824,242	$75,406,956	13,335,107	$24,369,277	124	$232	1,429	$7,200	13,336,660
1926	60,382,329	79,307,877	15,407,398	28,500,209	496	2,743	-------	-------	15,407,894
1927	58,382,632	78,609,117	15,843,646	25,944,822	-------	-------	-------	-------	15,843,646
1928	79,766,672	90,473,284	18,962,357	26,787,866	270	1,077	3,339	3,005	18,965,966
1929	78,932,572	79,943,429	26,394,358	37,799,706	2,135	2,145	5,005	5,259	26,401,498

SHIPMENTS FROM CALIFORNIA THROUGH THE PANAMA CANAL

Shipments of crude oil from California through the Panama Canal to eastern ports in the United States continued to decline and amounted to only 1,299,000 barrels in 1929, compared with 2,301,000 barrels in 1928. No shipments were recorded during the last four months of the year, as contrasted with 1923, when an average of approximately 150,000 barrels of crude passed through the canal every day. The price of crude in California was low in 1929, and this at first thought would appear to have stimulated shipments. That an increase in shipments did not occur was due primarily to the fact that Venezuelan and west Texas crudes were even lower in price and much closer at hand than California crude. Shipments of gasoline from California continued to increase and amounted to 23,483,000 barrels in 1929. Shipments of gas oil, presumably for use as cracking stock, were also higher. Fuel-oil prices were low on the Atlantic and Gulf coasts and shipments through the canal were negligible in 1929. This situation prevailed even though fuel-oil stocks in California rose to new high levels.

California oil shipped through the Panama Canal to Atlantic and Gulf ports in the United States, 1928 and 1929, by months [1]

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1928													
Crude oil	234	415	423	234	162	182	241	163	100	-----	147	-----	2,301
Refined oils:													
Gasoline, naphtha, etc	1,072	910	1,150	1,182	1,386	1,589	1,745	1,700	1,269	1,601	1,288	1,887	16,779
Tops	-----	-----	-----	-----	76	-----	95	88	-----	80	-----	-----	339
Kerosene	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	1
Gas oil	267	93	257	93	251	-----	362	165	79	245	262	250	2,324
Diesel oil	45	-----	-----	77	-----	-----	-----	-----	-----	38	20	-----	180
Fuel oil	2	79	196	266	86	80	2	2	2	128	2	3	848
Lubricants	85	1	69	70	1	-----	1	5	24	4	73	2	335
Asphalt	1	2	6	1	1	2	1	3	3	4	3	2	29
Total refined	1,472	1,085	1,678	1,689	1,801	1,672	2,206	1,963	1,377	2,100	1,648	2,144	20,835
Total crude and refined	1,706	1,500	2,101	1,923	1,963	1,854	2,447	2,126	1,477	2,100	1,795	2,144	23,136
1929													
Crude oil	-----	241	155	-----	95	170	440	198	-----	-----	-----	-----	1,299
Refined oils:													
Gasoline, naphtha, etc	1,823	1,735	1,550	2,110	1,498	1,598	2,346	2,367	2,050	2,299	2,131	1,976	23,483
Kerosene	-----	-----	-----	-----	-----	-----	72	-----	-----	54	50	53	229
Gas oil	334	343	480	113	79	77	-----	203	658	491	290	656	3,724
Diesel oil	-----	-----	-----	20	-----	2	76	-----	-----	-----	42	-----	140
Fuel oil	-----	8	51	2	2	3	4	-----	3	28	3	75	179
Lubricants	2	2	1	1	1	71	1	71	9	12	-----	11	182
Asphalt	3	3	3	2	3	2	2	2	2	2	2	2	28
Total refined	2,162	2,091	2,085	2,248	1,583	1,753	2,501	2,643	2,722	2,886	2,518	2,773	27,965
Total crude and refined	2,162	2,332	2,240	2,248	1,678	1,923	2,941	2,841	2,722	2,886	2,518	2,773	29,264

[1] Compiled by E. T. Knudsen, of the San Francisco office of the Bureau of Mines.

STOCKS

In this report stocks of crude petroleum are classified as follows:

1. Refinery stocks or stocks held at refineries. These are reported separately for east of California only. Data concerning stocks held by other consumers are not available.
2. Pipe-line and tank-farm stocks or petroleum that has been transported from the producing properties but has not been delivered at refineries or other points of consumption. For States east of California such stocks are reported monthly as gross stocks, which include the total contents of tanks and pipe lines, and as net stocks, which are gross stocks minus sediment and water. The stocks reported for California were compiled by the San Francisco office of the Bureau of Mines and include all stocks of crude petroleum and fuel oil held on the Pacific coast, divided into two classes—light or refinable crude (20° A. P. I. and above) and heavy crude (under 20° A. P. I.) and fuel oil.

3. Producers' stocks, or petroleum held at the wells on the producing properties. Producers' stocks are reported annually and during the past several years have amounted to between 5,000,000 and 10,000,000 barrels annually.

4. Stocks of foreign crude petroleum held by importers elsewhere than at refineries.

The material increase in the production of crude petroleum in 1929 was reflected in crude stocks, for, although consumption by refineries increased, total stocks of crude showed a gain of nearly 50,000,000 barrels. Total stocks of crude petroleum (including fuel oil in California) amounted to 540,851,000 barrels on December 31, 1929, compared with 491,847,000 barrels on hand the first of the year, an increase of 49,004,000 barrels. This increase was composed of approximate accumulations in refinery stocks of 5,500,000 barrels, in pipe-line and tank-farm stocks east of California of 7,500,000 barrels, in stocks of light crude in California of 23,000,000 barrels, and in stocks of heavy crude and fuel oil in California of 13,000,000 barrels. (See fig. 14.) The only classes of crude stocks which decreased during 1929 were producers' stocks and stocks of foreign oil held by importers. Pipe-line and tank-farm stocks, the leading class of crude stocks from the standpoint of volume and general economic importance, increased in every month of 1929 except April, May, October, November, and December. The declines of April and May were of considerable economic importance as they followed a curtailment program in the Mid-Continent field and supplied the principal basis for the price increase instituted in the latter half of May.

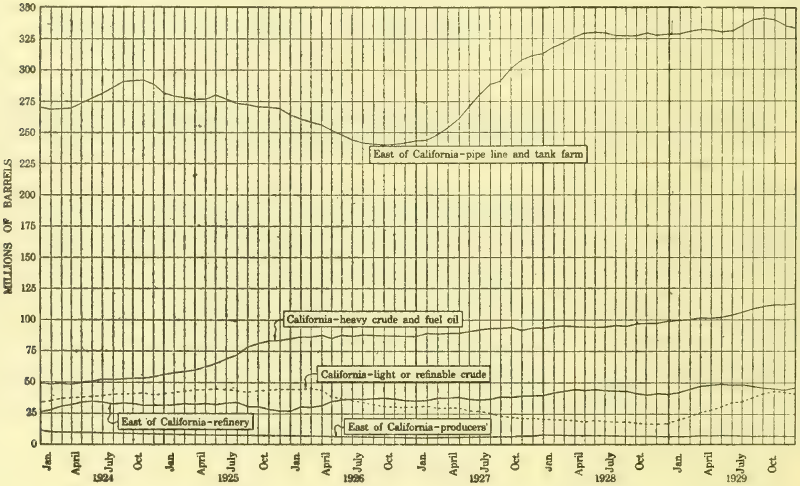

FIGURE 14.—Stocks of crude petroleum, 1924-1929, by months

Stocks of crude petroleum in the United States on December 31, 1925–1929

[Thousands of barrels of 42 U. S. gallons]

Year	Refinery stocks of crude petroleum [1]	Pipe-line and tank-farm stocks of domestic crude petroleum, by fields of origin								Producers' stocks[1]	Foreign petroleum held by importers	Total
		Appalachian	Lima-Indiana	Illinois-southwest Indiana	Mid-Continent	Gulf coast	Rocky Mountain	California [2]	Total			
1925	27,157 [3] 29,200	8,493	971	10,582	195,941	19,263	28,995	129,434 [4] 130,234	393,679 [4] 394,479	7,560	407	428,803 [3] [4] 431,646
1926	35,475	7,790	666	11,770	173,848	20,031	28,075	118,131 [5] 119,170	360,311 [5] 361,350	5,904	609	402,299 [5] 403,338
1927	39,317	7,334	1,134	12,170	246,839	17,922	27,238	113,805	426,442	7,536	84	473,379
1928	40,529	5,515	1,162	11,367	265,748	18,272	25,501	115,914 [6] 116,973	443,479 [6] 444,538	6,521	259	490,788 [6] 491,847
1929	46,195	5,239	544	10,411	273,912	20,129	24,656	153,455	488,346	6,198	112	540,851

[1] Exclusive of California.
[2] Includes refinery and producers' stocks.
[3] Includes 2,043,000 barrels in coastwise transit—for comparison with 1926 figures.
[4] Includes 800,000 barrels working stocks not previously recorded.
[5] Figures for comparison with succeeding years.
[6] Figures for comparison with 1929.

Stocks of crude petroleum held in the United States at end of each month, 1928 and 1929

[Thousands of barrels of 42 U. S. gallons]

		January	February	March	April	May	June	July	August	September	October	November	December
1928													
East of California:													
At refineries, by location of storage—													
East coast—													
Domestic		8,469	8,463	8,706	7,979	7,778	8,409	8,698	9,154	8,053	8,235	8,243	8,496
Foreign		4,004	4,323	5,414	5,866	6,140	5,862	5,349	4,946	3,964	3,686	3,773	4,306
Appalachian		1,883	1,956	2,060	2,166	2,266	2,242	2,186	2,258	2,185	2,131	2,235	2,183
Indiana, Illinois, Kentucky, etc		2,812	2,904	3,015	3,148	3,097	2,957	3,053	2,891	2,759	2,931	2,982	2,939
Oklahoma, Kansas, and Missouri		5,655	5,888	5,759	5,889	6,193	5,662	5,688	5,208	5,247	5,329	5,849	5,530
Texas—													
Inland		1,484	1,554	1,665	1,558	1,790	1,927	1,863	1,926	1,767	1,712	1,885	2,184
Gulf coast—													
Domestic		8,006	7,996	7,868	8,132	8,110	8,469	8,152	7,814	8,189	7,663	7,399	7,206
Foreign		153	263	383	243	111	102	150	54	128	158	179	207
Arkansas and inland Louisiana		441	578	654	684	797	881	840	882	852	936	1,098	758
Louisiana, Gulf coast—													
Domestic		5,886	6,063	5,859	5,343	4,722	4,149	4,462	4,690	4,656	4,220	3,954	3,315
Foreign		1,289	1,230	1,080	1,053	979	970	1,194	1,049	1,117	1,031	1,153	1,359
Rocky Mountain		1,498	1,610	1,655	1,541	1,430	1,488	1,440	1,545	1,680	1,774	2,017	2,046
Total at refineries		41,580	42,828	44,118	43,602	43,413	43,118	43,075	42,417	40,597	39,806	40,767	40,529
Pipe-line and tank-farm stocks—													
Domestic petroleum, by fields of origin—													
Appalachian—													
New York, Pennsylvania, West Virginia, eastern and central Ohio	Gross	6,471	6,551	6,490	6,269	6,285	6,365	6,202	5,960	5,689	5,573	5,318	5,036
	Net	6,160	6,240	6,181	5,959	5,977	6,068	5,910	5,657	5,375	5,270	5,023	4,751
Kentucky	Gross	1,176	1,191	1,249	1,337	1,335	1,230	1,267	1,158	999	986	961	913
	Net	1,048	1,063	1,121	1,208	1,200	1,097	1,139	1,040	845	834	810	764
Lima-Indiana	Gross	1,282	1,306	1,390	1,377	1,415	1,447	1,513	1,528	1,529	1,517	1,397	1,344
	Net	1,128	1,153	1,210	1,196	1,234	1,267	1,333	1,348	1,346	1,335	1,214	1,162
Illinois-southwestern Indiana	Gross	12,616	12,534	12,711	12,720	12,776	12,702	12,551	12,570	12,195	12,107	11,927	12,035
	Net	12,122	12,039	12,208	12,217	12,273	12,200	12,049	11,909	11,527	11,440	11,260	11,367
Mid-Continent—													
Oklahoma, Kansas, north, central, west, and Panhandle Texas	Gross	238,229	242,263	247,448	250,252	250,543	249,610	247,487	248,109	248,361	250,331	250,505	251,849
	Net	225,964	229,736	234,613	237,530	237,727	236,770	235,087	235,597	236,105	238,241	238,581	239,345
North Louisiana and Arkansas	Gross	28,455	28,645	28,775	29,024	28,984	29,711	29,816	29,284	28,894	29,037	28,402	29,131
	Net	25,837	26,131	25,735	26,286	26,358	26,747	26,621	26,176	26,125	26,072	25,638	26,403
Gulf coast	Gross	18,550	17,853	17,192	17,073	17,015	17,527	17,689	18,304	18,795	19,237	18,826	18,826
	Net	18,161	17,458	16,818	16,669	16,596	17,030	17,235	17,813	18,308	18,753	18,373	18,272

Rocky Mountain	Gross	27,324	27,198	27,358	27,334	27,174	27,075	26,984	26,702	26,333	26,031	25,747	25,522
	Net	27,280	27,154	27,315	27,291	27,130	27,036	26,943	26,665	26,295	25,991	25,714	25,501
Total pipe-line and tank-farm	Gross	334,103	337,541	342,613	345,386	345,527	345,667	343,509	343,615	342,795	344,819	343,083	344,656
	Net	317,700	320,974	325,201	328,356	328,495	328,215	326,317	326,205	325,926	327,936	326,613	327,565
Foreign crude petroleum held in United States by importers—													
At Atlantic coast stations		40	43	75	65	58	91	40	23	43	52	67	49
At Gulf coast stations		43	14	45	54	51	51	42	62	154	155	175	210
Total		83	57	120	119	109	142	82	85	197	207	242	259
Producers' stocks[1]		7,450	7,370	7,284	7,201	7,115	7,032	6,946	6,860	6,777	6,691	6,608	6,521
Total crude stocks east of California		366,813	371,229	376,723	379,278	379,132	378,507	376,420	375,567	373,497	374,640	374,230	374,874
California		114,899	114,970	114,095	113,141	113,341	113,431	113,878	113,367	113,433	113,709	113,963	115,914 [2]116,973
Total		481,712	486,199	490,818	492,419	492,473	491,938	490,298	488,934	486,930	488,349	488,193	490,788 [2]491,847
Classification by gravity:													
East of California[3]—													
Light crude (24° and above)		309,475	313,137	318,261	319,770	320,429	319,585	318,087	317,538	317,203	319,221	319,199	319,928
Heavy crude (below 24°)		49,888	50,722	51,178	52,307	51,588	51,890	51,387	51,169	49,517	48,728	48,423	48,425
California—													
Light crude (20° and above)		20,562	20,142	19,579	18,782	19,470	19,197	18,215	18,310	16,870	16,684	16,524	16,995 [2]17,755
Heavy crude (below 20° and including fuel oil)		94,337	94,828	94,516	94,359	93,871	94,234	95,663	95,057	96,563	97,025	97,439	98,919 [2]99,218

[1] Figures for December based on reports from companies; other months prorated.

[2] For comparison with 1929.

[3] Exclusive of producers' stocks.

Stocks of crude petroleum held in the United States at end of each month, 1928 and 1929—Continued

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December
1929												
East of California:												
At refineries, by location of storage—												
East coast—												
Domestic	8, 340	9, 129	9, 050	9, 442	9, 367	8, 202	9, 292	9, 221	8, 899	8, 940	8, 695	8, 955
Foreign	5, 072	5, 690	6, 380	6, 313	6, 484	5, 382	4, 910	4, 370	3, 748	4, 067	3, 208	3, 989
Appalachian	2, 256	2, 358	2, 496	2, 493	2, 645	2, 591	2, 723	2, 697	2, 803	2, 830	2, 952	2, 953
Indiana, Illinois, Kentucky, etc	2, 856	2, 839	3, 094	2, 932	2, 974	2, 945	3, 119	2, 834	2, 809	2, 859	3, 199	3, 305
Oklahoma, Kansas, and Missouri	6, 087	6, 182	6, 411	6, 609	6, 643	6, 796	6, 571	6, 475	5, 669	5, 505	5, 372	5, 610
Texas—												
Inland	2, 166	1, 855	1, 952	2, 150	2, 464	2, 578	1, 753	1, 716	1, 745	1, 798	1, 702	2, 034
Gulf coast—												
Domestic	8, 130	8, 190	8, 417	9, 016	9, 492	9, 802	10, 512	10, 461	10, 438	10, 144	10, 519	10, 749
Foreign	310	273	392	598	344	533	397	372	557	615	585	485
Arkansas and inland Louisiana	841	1, 260	1, 310	1, 223	1, 470	1, 402	1, 511	1, 468	1, 347	1, 183	1, 046	1, 050
Louisiana, Gulf coast—												
Domestic	2, 731	3, 103	2, 986	3, 311	3, 391	3, 975	4, 160	4, 104	4, 384	4, 122	3, 910	3, 930
Foreign	1, 717	1, 845	2, 316	2, 070	1, 818	1, 649	1, 530	1, 469	1, 663	1, 574	1, 535	1, 499
Rocky Mountain	2, 098	2, 066	2, 108	2, 123	2, 075	2, 028	1, 933	1, 811	1, 343	1, 426	1, 512	1, 636
Total at refineries	42, 604	44, 790	46, 912	48, 280	49, 167	47, 883	48, 411	46, 998	45, 405	45, 063	44, 235	46, 195
Pipe-line and tank-farm stocks—												
Domestic petroleum, by fields of origin—												
Appalachian—												
New York, Pennsylvania, West Virginia, eastern and central Ohio: Gross	4, 977	4, 983	5, 001	5, 032	5, 014	4, 938	4, 834	4, 788	4, 857	4, 890	4, 789	4, 965
Net	4, 695	4, 698	4, 711	4, 753	4, 733	4, 659	4, 551	4, 548	4, 524	4, 572	4, 475	4, 665
Kentucky: Gross	954	962	946	1, 020	1, 011	922	976	950	906	947	828	708
Net	807	815	799	874	866	778	834	789	765	805	690	574
Lima-Indiana: Gross	1, 298	1, 268	1, 177	1, 162	1, 037	953	915	820	715	656	663	731
Net	1, 115	1, 085	994	979	854	770	732	637	529	470	477	544
Illinois-southwestern Indiana: Gross	11, 978	11, 920	12, 001	11, 808	11, 786	11, 525	11, 273	11, 254	11, 004	11, 064	11, 073	11, 113
Net	11, 312	11, 254	11, 343	11, 150	11, 128	10, 868	10, 615	10, 598	10, 302	10, 363	10, 371	10, 411
Mid-Continent—												
Oklahoma, Kansas, north, central, west, and Panhandle Texas: Gross	253, 169	256, 061	257, 932	257, 780	257, 314	258, 660	262, 700	267, 916	269, 925	268, 784	265, 926	265, 102
Net	240, 554	243, 844	245, 383	244, 919	244, 430	245, 856	249, 910	254, 638	257, 018	255, 935	253, 195	252, 322
North Louisiana and Arkansas: Gross	29, 205	28, 636	28, 043	28, 234	27, 197	26, 879	26, 856	26, 618	25, 958	25, 455	25, 062	25, 229
Net	26, 413	25, 836	25, 196	24, 867	23, 278	23, 148	23, 079	22, 867	22, 252	21, 815	21, 460	21, 590
Gulf coast: Gross	19, 261	18, 991	19, 974	20, 474	20, 893	21, 234	21, 047	21, 039	21, 257	21, 153	20, 879	20, 547
Net	18, 788	18, 521	19, 490	19, 966	20, 381	20, 680	20, 473	20, 497	20, 715	20, 700	20, 460	20, 129

Rocky Mountain	Gross	25,265	25,174	24,976	24,671	24,501	24,341	24,390	24,533	24,799	24,733	24,716	24,717
	Net	25,237	25,141	24,942	24,635	24,462	24,303	24,339	24,476	24,739	24,673	24,659	24,656
Total pipe-line and tank-farm	Gross	346,107	347,995	350,050	350,181	348,753	349,452	352,991	357,918	359,421	357,682	353,936	353,112
	Net	328,921	331,194	332,858	332,143	330,132	331,062	334,533	339,050	340,844	339,333	335,787	334,891
Foreign crude petroleum held in United States by importers—													
At Atlantic coast stations		69	83	59	94	110	60	85	67	45	71	105	80
At Gulf coast stations		267	320	233	191	173	154	137	99	71	44	25	32
Total		336	403	292	285	283	214	222	166	116	115	130	112
Producers' stocks[1]		6,563	6,474	6,505	6,551	6,728	6,704	6,547	6,470	6,433	6,314	6,231	6,198
Total crude stocks east of California		378,424	382,861	386,567	387,259	386,310	385,863	389,713	392,684	392,798	390,825	386,383	387,396
California		119,101	123,059	126,422	128,902	132,670	137,241	140,270	146,298	150,759	154,361	153,454	153,455
Total		497,525	505,920	512,989	516,161	518,980	523,104	529,983	538,982	543,557	545,186	539,837	540,851
Classification by gravity:													
East of California[3]—													
Light crude (24° and above)		326,465	330,176	333,279	334,365	334,270	334,416	339,921	344,265	345,298	344,195	341,204	341,829
Heavy crude (below 24°)		45,396	46,211	46,783	46,343	45,312	44,743	43,245	41,949	41,067	40,316	38,948	39,369
California—													
Light crude (20° and above)		20,110	23,176	25,167	27,774	30,451	33,369	34,583	37,853	40,627	42,676	42,005	41,049
Heavy crude (below 20° and including fuel oil)		98,991	99,883	101,255	101,128	102,219	103,872	105,687	108,445	110,132	111,685	111,449	112,406

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[1] Figures for December based on reports from companies; other months prorated.

[3] Exclusive of producers' stocks.

CONSUMPTION

The indicated domestic demand for all oils, as given in the tables on pages 427 and 428, amounted to 940,083,000 barrels, an increase of 79,649,000 barrels, or 9 per cent, over 1928. Domestic demand for all oils consists primarily of refined products delivered from refineries but includes also the quantity of crude used for fuel in the raw state and all losses incident to the handling of the crude and refined products up to the time they leave the refineries. In addition, 26,401,000 barrels of crude and 136,719,000 barrels of refined oils were exported, so that the total demand for all oils in 1929 was 1,103,203,000 barrels, an increase of 9 per cent also over 1928.

Computation of the domestic demand for crude petroleum alone is not possible under the industry's present system of reporting stocks, but a fairly accurate determination of the consumption of crude may be made through an analysis of crude runs to stills.

The consumption of crude petroleum at refineries in the United States established a new record in 1929 when a total of 987,708,000 barrels was processed, an increase of 8 per cent over 1928. Of the total, 912,191,000 barrels, or 92 per cent, was domestic crude oil and 75,517,000 barrels, or 8 per cent, was foreign crude oil. Compared with 1928, these data represent a gain of 76,480,000 barrels in the use of domestic crude oil, but a decline of slightly more than 2,000,000 barrels in the use of foreign crudes.

Daily average runs to stills in January, 1929, were below those in December, 1928, but from February 1 to July 1 they increased steadily (see fig. 15). A recession in refining activity occurred in July, but August, September, and October witnessed a steady gain in crude oil processed.

The California district reported the largest increase in runs to stills in 1929, with Texas second and Indiana-Illinois third. The major part of the increase in Texas was due to enlarged operations at a comparatively few refineries in the Gulf coast. On a percentage basis the gain of almost 10,000,000 barrels in runs to stills in west Texas was more important than the increase in the Texas Gulf coast area.

The consumption of foreign crude at refineries in the United States, which had shown a steady increase in 1926, 1927, and 1928, declined slightly in 1929. Foreign crude is refined chiefly on the Atlantic seaboard, but a few refineries on the Gulf of Mexico also use foreign crude. The foreign crude used on the East coast is principally Venezuelan oil, whereas that refined on the Gulf coast is mainly Mexican. The decline in use of foreign crude by East coast refiners in 1929, in the face of increased production in Venezuela, was due principally to the fact that a part of the business was diverted to a new refinery on the Island of Aruba, off the Venezuelan coast.

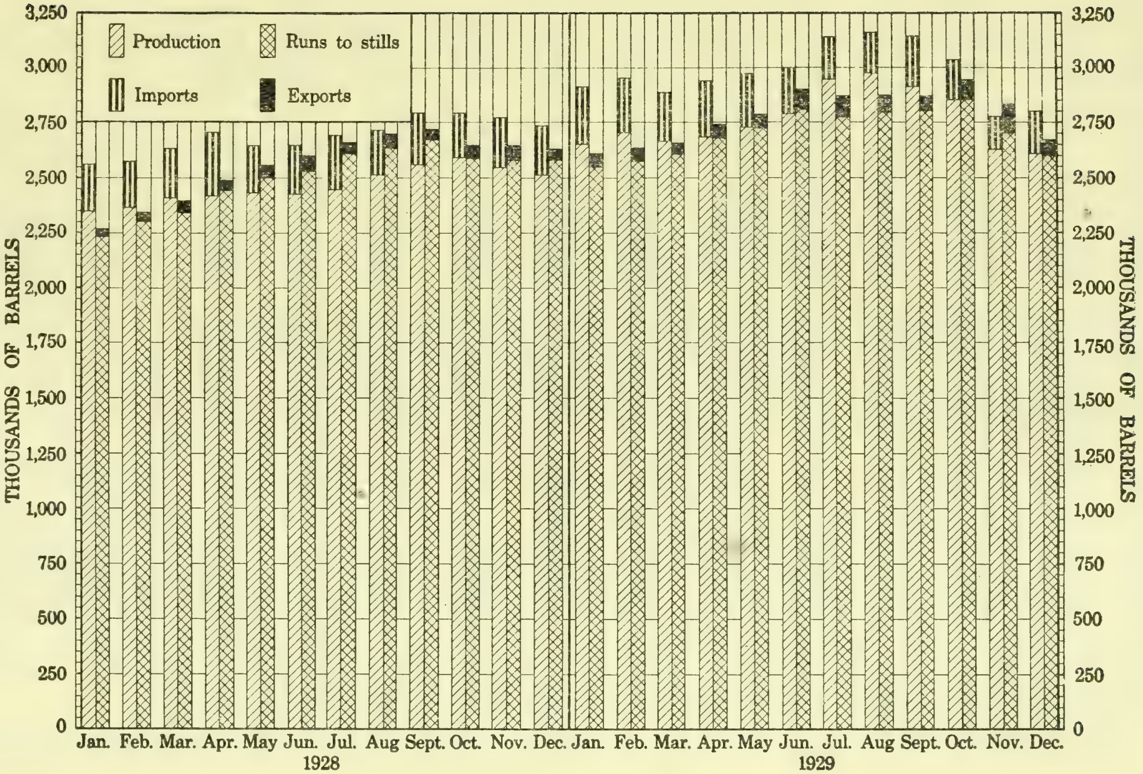

FIGURE 15.—Daily average production, imports, runs to stills, and exports of crude petroleum, 1928 and 1929, by months

Crude petroleum run to stills at refineries in the United States, 1928 and 1929, by districts and months

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1928													
East coast:													
Domestic	8,893	8,293	8,302	8,300	8,569	8,288	8,837	9,104	8,587	8 397	7,818	8,332	101,720
Foreign	4,648	4,764	5,284	5,355	5,937	6,686	6,572	5,901	6,078	5,940	5,757	5,864	68,786
Appalachian	2,445	2,367	2,593	2,644	2,827	2,885	2,998	3,048	3,071	2,994	2,841	2,930	33,643
Indiana, Illinois, Kentucky, etc	7,077	6,717	7,710	7,488	8,426	8,536	8,832	9,209	9,011	8,765	8,632	8,502	98,905
Oklahoma, Kansas, and Missouri	8,294	7,870	8,726	8,880	9,581	9,228	9,789	10,329	10,103	9,984	9,189	9,369	111,342
Texas:													
Inland	3,061	3,042	3,549	3,567	3,895	3,757	4,622	4,864	4,434	4,614	4,328	4,363	48,096
Gulf coast—													
Domestic	10,982	10,658	11,291	11,618	11,720	10,722	11,766	11,883	11,170	11,131	11,857	11,936	136,734
Foreign	53	67	56	70	117	70	94	97	87	297	129	109	1,246
Arkansas and inland Louisiana	1,475	1,489	1,696	1,740	2,031	1,783	2,003	2,073	2,135	2,087	2,067	2,096	22,675
Louisiana, Gulf coast:													
Domestic	3,744	3,242	3,590	3,859	4,210	3,770	3,600	3,412	3,901	3,920	3,992	4,073	45,313
Foreign	321	457	392	414	560	490	503	992	944	1,161	670	648	7,552
Rocky Mountain	1,978	1,844	2,046	2,140	2,369	2,180	2,314	2,315	2,279	2,282	2,161	2,153	26,061
California	16,190	15,838	17,386	17,009	17,172	17,563	18,672	18,354	18,094	18,091	17,708	19,145	211,222
	69,161	66,648	72,621	73,084	77,414	75,958	80,602	81,581	79,894	79,663	77,149	79,520	913,295
1929													
East coast:													
Domestic	8,358	7,459	8,283	8,354	8,769	9,006	8,356	9,656	9,079	9,718	9,403	9,746	106,187
Foreign	5,687	5,319	5,630	5,424	6,039	6,294	5,856	5,588	5,495	5,233	5,171	4,511	66,247
Appalachian	2,878	2,417	2,767	2,918	3,040	3,082	2,950	2,767	2,771	2,978	2,649	2,585	33,802
Indiana, Illinois, Kentucky, etc	8,611	7,754	8,504	8,733	9,226	9,464	9,832	10,354	9,560	9,837	9,264	9,210	110,349
Oklahoma, Kansas, and Missouri	9,136	8,101	9,298	9,539	10,006	9,904	10,083	10,318	9,855	9,962	9,689	9,558	115,449
Texas:													
Inland	4,289	4,218	4,681	5,024	5,637	5,248	5,275	5,108	4,760	5,049	4,631	4,393	58,313
Gulf coast—													
Domestic	11,816	11,613	12,725	12,009	12,401	12,069	12,607	12,198	13,216	14,174	12,843	12,836	150,507
Foreign	100	37	118	403	473	469	219	338	112	138	167	299	2,873
Arkansas and inland Louisiana	1,897	1,874	2,233	2,145	2,200	2,132	1,963	2,055	2,313	2,211	1,916	1,838	24,777
Louisiana, Gulf coast:													
Domestic	4,008	3,539	3,801	3,557	3,818	3,519	3,521	3,700	3,443	3,945	3,655	3,748	44,254
Foreign	639	723	866	833	692	528	338	364	384	297	360	373	6,397
Rocky Mountain	2,134	1,881	2,173	2,181	2,261	2,222	2,316	2,253	2,151	2,139	1,869	1,863	25,443
California	19,272	17,096	19,629	19,339	19,858	20,463	22,603	22,034	20,960	22,709	19,444	19,703	243,110
	78,825	72,031	80,708	80,459	84,420	84,400	85,919	86,733	84,099	88,390	81,061	80,663	987,708

Indicated deliveries of crude petroleum (exclusive of California grades) to domestic consumers, 1928 and 1929, by months [1]

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1928													
Domestic petroleum, by fields of origin:													
Appalachian	2, 530	2, 321	2, 650	2, 650	2, 755	2, 583	2, 785	3, 076	2, 952	2, 895	2, 826	2, 885	32, 908
Lima-Indiana	130	107	88	152	125	125	93	130	132	153	238	176	1, 649
Michigan	31	30	29	37	47	50	56	46	37	73	88	71	595
Illinois and southwestern Indiana	629	674	538	534	599	701	784	799	970	733	775	496	8, 232
Mid-Continent	39, 660	37, 818	41, 205	41, 493	45, 512	44, 238	47, 578	48, 003	47, 691	48, 104	46, 870	46, 779	534, 951
Gulf coast	3, 486	4, 032	4, 373	3, 788	4, 156	3, 606	3, 958	3, 580	3, 355	3, 586	4, 235	4, 176	46, 331
Rocky Mountain [2]	2, 381	2, 323	2, 422	2, 375	2, 722	2, 541	2, 577	2, 872	2, 804	2, 902	2, 641	2, 524	31, 084
Deliveries and exports	48, 847	47, 305	51, 305	51, 029	55, 916	53, 844	57, 831	58, 506	57, 941	58, 446	57, 673	57, 107	655, 750
Exports	745	741	886	802	1, 081	1, 458	1, 174	1, 515	1, 007	1, 579	1, 181	1, 115	13, 284
Deliveries	48, 102	46, 564	50, 419	50, 227	54, 835	52, 386	56, 657	56, 991	56, 934	56, 867	56, 492	55, 992	642, 466
Foreign petroleum	6, 331	6, 062	6, 781	5, 662	6, 776	6, 520	7, 938	6, 138	7, 027	6, 693	6, 873	6, 790	79, 591
	54, 433	52, 626	57, 200	55, 889	61, 611	58, 906	64, 595	63, 129	63, 961	63, 560	63, 365	62, 782	722, 057
1929													
Domestic petroleum, by fields of origin:													
Appalachian	2, 602	2, 338	2, 652	2, 596	2, 923	2, 830	3, 073	2, 961	2, 900	3, 111	3, 148	2, 960	34, 094
Lima-Indiana	155	129	219	140	259	236	202	248	233	193	108	43	2, 165
Michigan	158	129	144	157	231	478	694	622	494	519	460	409	4, 495
Illinois and southwestern Indiana	645	593	590	725	651	847	885	663	898	582	576	528	8, 183
Mid-Continent	47, 375	41, 487	46, 905	47, 355	51, 443	46, 851	49, 125	48, 790	48, 346	50, 848	48, 939	48, 185	575, 649
Gulf coast	3, 847	4, 182	3, 457	4, 297	4, 269	4, 136	4, 839	4, 852	4, 545	5, 406	5, 521	5, 677	55, 028
Rocky Mountain [2]	2, 421	2, 043	2, 408	2, 444	2, 435	2, 431	2, 363	2, 339	2, 156	2, 497	2, 301	2, 334	28, 172
Deliveries and exports	57, 203	50, 901	56, 375	57, 714	62, 211	57, 809	61, 181	60, 475	59, 572	63, 156	61, 053	60, 136	707, 786
Exports	1, 268	902	1, 171	954	1, 443	1, 819	2, 389	1, 627	1, 598	2, 138	1, 855	1, 323	18, 487
Deliveries	55, 935	49, 999	55, 204	56, 760	60, 768	55, 990	58, 792	58, 848	57, 974	61, 018	59, 198	58, 813	689, 299
Foreign petroleum	7, 998	6, 949	6, 901	7, 835	7, 554	6, 660	6, 114	5, 856	7, 003	5, 767	4, 539	5, 904	79, 080
	63, 933	56, 948	62, 105	64, 595	68, 322	62, 650	64, 906	64, 704	64, 977	66, 785	63, 737	64, 717	768, 379

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[1] Indicated deliveries equal production plus imports plus stocks, exclusive of refinery stocks, at beginning of **period** minus exports and stocks at end **of period.**

[2] Includes Alaska.

PRICES AND VALUES

The total value of crude petroleum produced in the United States amounted to $1,280,417,000 in 1929, compared with $1,054,880,000 in 1928. The increase in total value resulted primarily from the material gain in production, although about $120,000,000 of it resulted from the general stiffening of posted prices in May. The average price per barrel paid for crude petroleum at the wells was $1.27 in 1929, compared with $1.17 in 1928 and $1.30 in 1927.

The record of average crude prices, by States, in 1929 exhibited the usual wide discrepancies, attributable principally to the grade of oil. The range in average values in 1929 was from $0.88 per barrel for Arkansas crude to $4.29 per barrel for the combined output of crude in Alaska and Utah. Except for Alaska and Utah, only two States, Michigan and New Mexico, had a lower average value than in 1928, an indication of the widespread nature of the price advances of 1929.

Posted prices for typical Appalachian crudes, which were advanced six times in 1928 without a recession, suffered five declines in 1929 (after January 4) with no advances. (See fig. 16.) However, the average for the year was considerably above that for 1928. Posted prices for Mid-Continent crude were low as the year 1929 opened, and were reduced still lower on January 25. Because of the likelihood that the flush production from the Oklahoma City and Seminole fields could not be absorbed by the market, it appeared that prices would remain low throughout the summer; however, the brisk spring demand by refiners for crude caused a withdrawal from stocks of light crude in some areas. This unusual occurrence was interpreted by the crude-oil purchasers as sufficient justification for a price advance, and, accordingly, the posted prices for Mid-Continent crude were advanced on May 20, the increase amounting in some instances to more than 50 cents per barrel.

No further change in Mid-Continent crude prices occurred after May 20, although considerable sentiment was evidenced at times toward restoring prices to the level prevailing on January 1, 1929. The postings in the other fields of the country, with the exception of the Eastern States and California, moved in sympathy with the increase in the Mid-Continent field, the change coming either on the same day (May 20) or within two days thereafter. In California the price schedule for light or refinable crude that was in effect the first of the year 1929 was maintained until fall, although the rapid increase in production at Santa Fe Springs threatened several times to cause lower prices. The coming of the period of lowered consumption and the inability of the producers in the Santa Fe Springs field to cooperate in a curtailment program resulted, however, in a drastic reduction of prices on October 21. This cut, which for some grades was equal to half the original price, only lasted until November 8, when the old prices were restored. The price of low-gravity crude of fuel-oil grade in California declined in January to a low level and remained unchanged throughout the rest of the year.

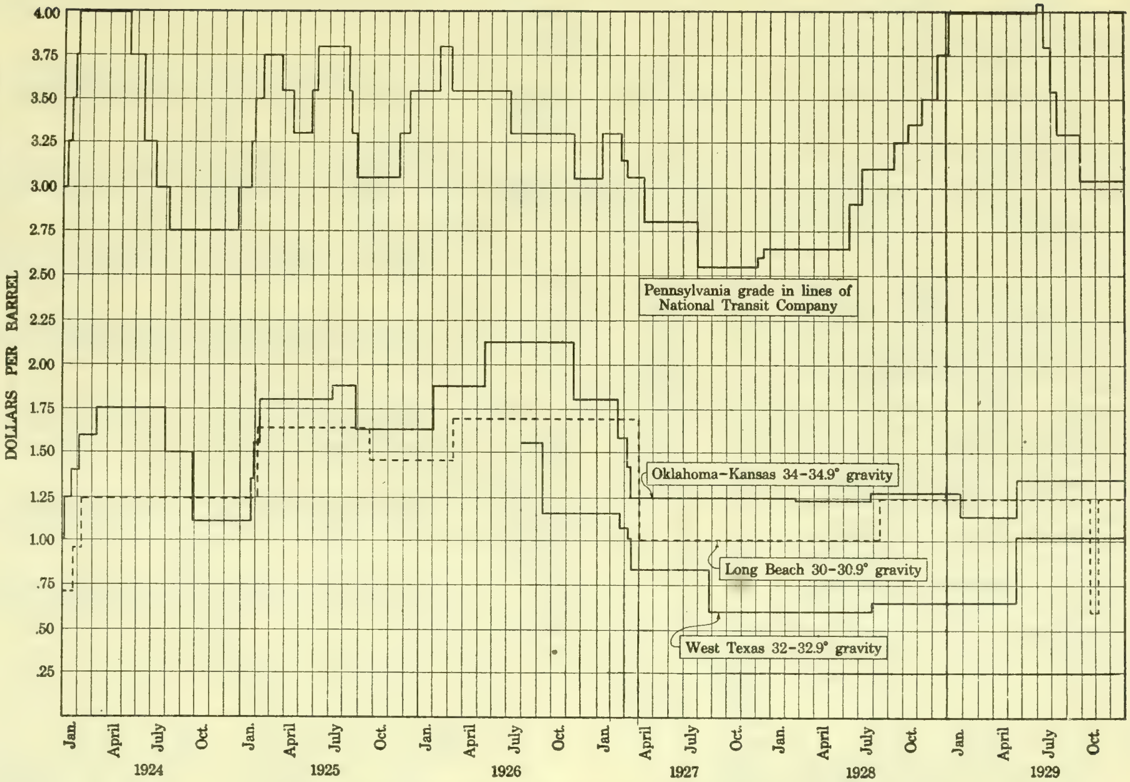

FIGURE 16.—Posted prices of selected grades of crude petroleum, 1924-1929

Average price per barrel paid for crude petroleum at the wells, 1925–1929, by States

[Based on actual purchases, including premiums]

State	1925	1926	1927	1928	1929
Alaska	$4.25	(1)	(1)	(1)	(1)
Arkansas	.89	$1.11	$1.06	$0.86	$0.88
California [2]	1.42	1.54	1.13	.99	1.10
Colorado	1.48	1.84	1.20	.99	1.01
Illinois	1.94	2.22	1.67	1.54	1.65
Indiana:					
Southwestern	1.92	2.22	1.65	1.53	1.66
Northeastern	2.06	2.07	1.51	1.24	1.43
Total Indiana	1.95	2.19	1.63	1.50	1.64
Kansas	1.94	2.26	1.42	1.36	1.46
Kentucky	2.32	2.43	1.67	1.61	1.70
Louisiana:					
Gulf coast	1.57	1.39	1.21	1.16	1.23
Northern	1.61	1.70	1.33	1.20	1.26
Total Louisiana	1.60	1.65	1.30	1.18	1.25
Michigan	2.50	2.69	1.90	1.55	1.36
Montana	1.57	1.32	1.40	1.59	1.82
New Mexico	1.71	1.96	1.37	1.36	1.19
New York	3.70	3.68	3.17	3.36	3.90
Ohio:					
Central and eastern	$2.67	$2.74	$2.02	$2.20	$2.51
Northwestern	2.17	2.34	1.80	1.59	1.73
Total Ohio	2.53	2.64	1.97	2.06	2.34
Oklahoma	1.97	2.31	1.43	1.39	1.43
Pennsylvania	3.62	3.56	3.06	3.27	3.79
Tennessee	2.21	2.33	1.50	1.52	1.58
Texas:					
Gulf coast	1.62	1.50	1.30	1.19	1.21
West Texas	1.86	1.96	1.10	.65	.83
Rest of State				1.15	1.33
Total Texas	1.81	1.85	1.14	.92	1.09
Utah	1.00	(1)	(1)	(1)	(1)
West Virginia	3.48	3.46	2.89	3.03	3.60
Wyoming	1.76	1.98	1.40	1.28	1.28
Other	------	[3] 1.25	[3] 4.71	[3] 5.00	[3] 4.29
United States	1.68	1.88	1.30	1.17	1.27

[1] Included under "Other."
[2] Division of Mines, Department of Natural Resources, California.
[3] Alaska and Utah.

Average monthly prices per barrel for selected grades of crude petroleum at wells, 1928 and 1929

	Pennsylvania grade [1]	Oklahoma-Kansas (38°–38.9°)	Gulf Coast Grade A	Illinois	Lima, Ohio	Panhandle (Carson and Hutchinson Counties 35°–35.9°)	California (Long Beach 30°–30.9°)	West Texas (Crane-Upton, etc., 30°–30.9°)
1928								
January	$2.65	$1.32	$1.20	$1.60	$1.71	$0.75	$1.00	$0.60
February	2.65	1.33	1.20	1.58	1.60	.76	1.00	.60
March	2.65	1.34	1.20	1.50	1.55	.79	1.00	.60
April	2.65	1.34	1.20	1.50	1.55	.79	1.00	.60
May	2.65	1.34	1.20	1.50	1.55	.79	1.00	.60
June	2.80	1.34	1.20	1.50	1.55	.79	1.00	.60
July	3.05	1.36	1.20	1.51	1.56	.81	1.00	.61
August	3.10	1.46	1.20	1.55	1.60	.91	1.14	.65
September	3.19	1.46	1.20	1.55	1.60	.91	1.25	.65
October	3.31	1.46	1.20	1.55	1.60	.91	1.25	.65
November	3.46	1.46	1.20	1.55	1.60	.91	1.25	.65
December	3.65	1.46	1.20	1.55	1.60	.91	1.25	.65
	2.98	1.39	1.20	1.54	1.59	.84	1.09	.62
1929								
January	3.98	1.41	1.20	1.53	1.58	.90	1.25	.65
February	4.00	1.26	1.20	1.45	1.50	.87	1.25	.65
March	4.00	1.26	1.20	1.45	1.50	.87	1.25	.65
April	4.00	1.26	1.20	1.48	1.53	.87	1.25	.65
May	4.00	1.37	1.24	1.65	1.70	.96	1.25	.76
June	4.00	1.55	1.30	1.75	1.80	1.10	1.25	.94
July	3.87	1.55	1.30	1.75	1.80	1.10	1.25	.94
August	3.37	1.55	1.30	1.75	1.80	1.10	1.25	.94
September	3.25	1.55	1.30	1.75	1.80	1.10	1.25	.94
October	3.00	1.55	1.30	1.75	1.80	1.10	1.02	.94
November	3.00	1.55	1.30	1.75	1.80	1.10	1.10	.94
December	3.00	1.55	1.30	1.75	1.80	1.10	1.25	.94
	3.62	1.45	1.26	1.65	1.70	1.01	1.22	.83

[1] In lines of Southwest Pennsylvania Pipe Line Co.

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change

Date	Appalachian field[1]														Lima-Indiana field[2]		Illinois and southwestern Indiana field[2]		
	Pennsylvania grade									Somerset grade									
	In lines of New York Transit Co. and Bradford grade in lines of National Transit Co.	In lines of National Transit Co.	nes of Southwest Pennsylvania Pipe Line Co.	In lines of Eureka Pipe Line Co.	In lines of Buckeye Pipe Line Co.	Cabell grade in lines of Eureka Pipe Line Co.	Corning grade in lines of Buckeye Pipe Line Co.[3]	Wooster[2]	Ragland	In lines of Cumberland Pipe Line Co.	In lines of Eureka Pipe Line Co.	Wayne Co., Ky., in lines of Cumberland Pipe Line Co.	Western Kentucky[2]	Tennessee[4]	Lima, Ohio	Indiana	Illinois and Princeton, Ind.	Plymouth	Waterloo
Jan. 1	$3.85	$3.75	$3.75	$3.65	$3.60	$1.45	$1.90	[5] $1.77	$0.95	$1.75			$1.63	$1.75	$1.60	$1.37	$1.55	$1.28	$1.35
Jan. 4	4.10	4.00	4.00	3.90	3.85														
Jan. 25							1.75	1.62					1.53		1.50	1.27	1.45	1.18	
Feb. 15									.60	1.60									
Feb. 16														1.60					
Mar. 12						1.35				1.50									
Mar. 16														1.50					
Apr. 10														1.55					
Apr. 26								1.75					1.68		1.65	1.42	1.60		
Apr. 27						1.50				1.65									
May 1														1.65					
May 21								1.90					1.83		1.80	1.57	1.75	1.28	
May 22						1.65	1.90			1.80									
June 1														1.80					
July 1	[6] 4.05	[6] 4.05																	
July 16	[6] 3.80	[6] 3.80	3.75	3.65	3.50														
Aug. 1	[6] 3.55	[6] 3.55	3.50	3.40	3.25	(7)													
Aug. 16	[6] 3.30	[6] 3.30	3.25	3.15	2.95														
Oct. 1	[6] 3.05	[6] 3.05	3.00	2.90	2.70														
Oct. 2													1.68						
Oct. 7														1.70					
Nov. 12										1.55	$1.29								
Dec. 6							1.80				1.39	$1.42							
Average for year	3.69	3.65	3.62	3.52	3.40		1.84	1.81	.64	1.70	1.34	1.42	1.69	1.71	1.70	1.47	1.65	1.25	1.35

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[1] The Joseph Seep purchasing agency, except as noted.
[2] The Ohio Oil Co.
[3] Corning crude run prior to Sept. 15, 1926, posted at 10 cents less.
[4] Paragon Development Co., same scale posted for Kentucky.
[5] Oil run prior to Oct. 17, 1928, 10 cents less.
[6] Oil run prior to July 1, 1929, 5 cents less.
[7] Discontinued.

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Date	Michigan															
	Muskegon[1]														Saginaw[2]	
	Dundee	Traverse													Berea sand	Sagi-naw sand
		32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44°–and above		
Jan. 1	(3)	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46	$1.51	$1.56	$1.61	$1.66	$1.71	$1.76	$1.84	$1.94
Jan. 25	(3)	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44		
Feb. 4															1.70	1.80
Feb. 7	$0.50															
Mar. 11	.60															
Apr. 15	.70															
May 20	1.00															
May 21		1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85		
May 22	1.10															
June 1															1.80	
June 26	1.25															
Sept. 17	(3)															
Average for year		1.19	1.23	1.28	1.32	1.36	1.41	1.45	1.50	1.54	1.58	1.63	1.67	1.71	1.77	1.81

Date	Mid-Continent field																					
	Kansas-Oklahoma; north and central Texas[4]																					Corsi-cana[5]
	Below 25°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above	Heavy
Jan. 1	$0.60	$0.67	$0.74	$0.81	$0.88	$0.95	$1.02	$1.09	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46	$1.51	$1.56	$1.61	$1.66	$1.71	$1.76	$1.10
Jan. 11																						.80
Jan. 25[6]		.66	.72	.78	.84	.90	.96	1.02	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	
May 20	.85	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	
Average for year	.75	.81	.86	.92	.97	1.03	1.08	1.14	1.19	1.23	1.28	1.32	1.37	1.41	1.45	1.50	1.54	1.58	1.63	1.67	1.71	.81

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[1] Standard Oil Co. of Indiana.
[2] Sun Oil Co.
[3] Same as Traverse.
[4] Prairie Oil & Gas Co., and other major purchasing companies.
[5] Magnolia Petroleum Co.
[6] Posted by Humble Oil & Refining Co. on Jan. 24.

Date	Mid-Continent field—Continued												
	South central and eastern Texas												South-west Texas, Mirando[2]
	Luling[1]	Salt Flat[2]	Somerset[3]							Van[4]			
			Below 33°	33°-33.9°	34°-34.9°	35°-35.9°	36°-36.9°	37°-37.9°	38° and above	33°	34°	35°	36°	
Jan. 1	$1.00		$1.05	$1.07	$1.09	$1.11	$1.13	$1.15	$1.17					$1.00
Jan. 7														.80
Jan. 11	.80													
Jan. 24		$0.80												
Apr. 8		1.00												
May 20	.90	1.25												.90
Nov.[4]										$1.096	$1.146	$1.196	$1.246	
Average for year	.87	1.12	1.05	1.07	1.09	1.11	1.13	1.15	1.17	1.096	1.146	1.196	1.246	.87

[1] Magnolia Petroleum Co.
[2] Humble Oil & Refining Co.
[3] Grayburg Pipe Line Co.
[4] Pure Oil Co.; production began in November, 1929.

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Date	Mid-Continent field—Continued																											
	West Texas and southeast New Mexico																											
	Mitchell County, Tex.[1]	Glasscock-Howard, Tex.[1]													Crane, Crockett, Pecos, Upton, and Winkler Counties, Tex., and Lea County, N. Mex.[2]													Artesia, N. Mex.[3]
		Except Chalk							Chalk																			
Jan. 1	$0.93	$0.60							$0.80						$0.65													$1.08
Jan. 26	.65								.65																			
		Glasscock-Howard																										
		Below 25°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36° and above	Below 25°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36° and above	
May 20	(4)	$0.70	$0.74	$0.78	$0.82	$0.86	$0.90	$0.94	$0.98	$1.02	$1.06	$1.10	$1.14	$1.18	$0.70	$0.74	$0.78	$0.82	$0.86	$0.90	$0.94	$0.98	$1.02	$1.06	$1.10	$1.14	$1.18	
Dec. 3						.84	.86	.88	.90	.92	.94	.96	.98	1.00														
Average for year		.66	.69	.71	.74	.76	.78	.81	.83	.85	.88	.90	.92	.94	.68	.71	.73	.76	.78	.80	.83	.85	.88	.90	.93	.95	.98	1.08

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[1] Magnolia Petroleum Co.; Mitchell County previously posted as Iatan.

[2] Continental Oil Co., Gulf Pipe Line Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Marland Refining Co., and The Texas Co. First posting by Gulf Pipe Line Co. of Winkler crude, Apr. 18; first posting by The Texas Co. of West Texas and Lea County, N. Mex., crude, May 1; first posting by Humble Oil & Refining Co. of Lea County, N. Mex., crude, May 20.

[3] Ohio Oil Co.

[4] Included with Crane, Upton, etc.

Date	Mid-Continent field—Continued													
	Panhandle[1]													
	Carson and Hutchinson													
	Below 32°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above
Jan. 1	$0.69	$0.76	$0.81	$0.86	$0.91	$0.96	$1.01	$1.06	$1.11	$1.16	$1.21	$1.26	$1.31	$1.36
Jan. 24[2]	.72	.78	--------	.84	.87	.90	.93	.96	.99	1.02	1.05	1.08	1.11	1.14
May 20	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55
Average for year	.83	.88	.93	.97	1.01	1.06	1.10	1.15	1.19	1.23	1.28	1.32	1.36	1.41

Date	Mid-Continent field—Continued																
	Panhandle—Continued																
	Gray[3]																
	Below 29°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above
Jan. 1	$0.68	$0.75	$0.82	$0.89	$0.96	$1.01	$1.06	$1.11	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46	$1.51	$1.56
	28°–28.9°																
Jan. 24[2]	$0.69	-------	.81	.87	.93	.96	.99	1.02	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29
	Below 29°																
May 20	$0.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70
Average for year	.82	.87	.93	.98	1.04	1.08	1.12	1.17	1.21	1.26	1.30	1.34	1.39	1.43	1.47	1.52	1.56

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[1] Continental Oil Co., Gulf Pipe Line Co., Humble Oil & Refining Co., Marland Refining Co., and The Texas Co. (first posting May 1).

[2] Posted Jan. 25 by Gulf Pipe Line Co.

[3] Humble Oil & Refining Co., Gulf Pipe Line Co., and The Texas Co. (first posting May 1).

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Date	Mid-Continent field—Continued															
	Panhandle—Continued															
	Wheeler[1]															
	Below 30°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above
Jan. 1	$0.65	$0.72	$0.79	$0.86	$0.91	$0.96	$1.01	$1.06	$1.11	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46
Jan. 24	.70	.76	.82	.88	-------	.94	.97	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24
May 20	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65
Average for year	.82	.88	.93	.98	1.03	1.07	1.11	1.16	1.20	1.25	1.29	1.33	1.38	1.42	1.46	1.51

Date	Mid-Continent field—Continued																					
	North Louisiana and Arkansas[3]																					
	Bellevue extra heavy below 32°	Calion below 24°[3]	Cotton Valley below 36°[4]	Urania[5]	Bull Bayou, Caddo, Crichton, De Soto, Haynesville, Homer, El Dorado																	
					Below 28°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above
Jan. 1	$1.25	$0.75	$0.75	$0.90	$0.81	$0.88	$0.95	$1.02	$1.09	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46	$1.51	$1.56	$1.61	$1.66	$1.71	$1.76
Jan. 26	1.20				.78	.84	.90	.96	1.02	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44
Jan. 28																						
Apr. 22				1.00																		
May 21																						
May 22		.85	.85	1.10	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85
May 29	1.30																					
Average for year	1.26	.81	.81	1.03	.92	.97	1.03	1.08	1.14	1.19	1.23	1.28	1.32	1.36	1.41	1.45	1.50	1.54	1.58	1.63	1.67	1.71

[1] Humble Oil & Refining Co.
[2] Standard Oil Co. of Louisiana, except as noted.
[3] Gulf Refining Co. of Louisiana.
[4] Higher grades posted with same price scale as Bull Bayou.
[5] Louisiana Oil & Refining Co.

Date	Mid-Continent field—Continued												
	North Louisiana and Arkansas [1]—Continued												
	Smackover		Stephens [2]						Champagnolle [3]				
	Below 24°	24° and above	Below 28°	28°-28.9°	29°-29.9°	30°-30.9°	31°-31.9°	32° and above	Below 24°	24°-27.9°	28°-29.9°	30°-32.9°	33° and above
Jan. 1	$0.75	$0.90	$0.75	$0.79	$0.83	$0.87	$0.91	$0.95	$0.75	$0.85	$1.00	$1.15	$1.25
Jan. 26													
Jan. 28			.70	.74	.78	.82	.86	.90					
Apr. 22													
May 21			.90	.94	.98	1.02	1.06	1.10					
May 22	.85	1.00											
May 29													
Average for year	.81	.96	.83	.87	.91	.95	.99	1.03	.75	.85	1.00	1.15	1.25

[1] Standard Oil Co. of Louisiana, except as noted.

[2] Atlantic Oil Producing Co.

[3] Root Refineries (Inc.).

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Date	Gulf coast field																							
	Coastal Texas [1]																						Coastal Louisiana [2]	
	High Island	Batson, Saratoga	Grade A	Grade B																	Markham [3]	Refugio [4]	Edgerley, Starks, Vinton	Jennings, Sorrento
				Below 25°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40° and above				
Jan. 1 [5]	$1.00	$1.20	$1.20	$1.15	$1.17	$1.19	$1.21	$1.23	$1.25	$1.27	$1.29	$1.31	$1.33	$1.35	$1.37	$1.39	$1.41	$1.43	$1.45	$1.47	$1.00	$0.70	$1.20	$1.15
Jan. 26 [5]	------	------	------	1.05	1.07	1.09	1.11	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	.90	------	------	------
															35° and above									
May 20 [6]	1.10	1.30	1.30	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.36	1.39	1.42	1.45	$1.48						1.00	------	1.30	1.25
Average for year	1.06	1.26	1.26	1.12	1.14	1.17	1.20	1.22	1.25	1.28	1.30	1.33	1.35	1.38	------						.97	.70	1.26	1.21

[1] Gulf Pipe Line Co., except as noted.
[2] Gulf Refining Co. of Louisiana.
[3] The Texas Co.
[4] Gulf Coast Pipe Line Co.
[5] All Grade B crudes over 35° posted by Humble Oil & Refining Co. at same price as 35° to 35.9°.
[6] All Grade B crudes for 34° to 44° gravities posted by Sun Pipe Line Co. with a differential of 4 cents for each degree of gravity.

Date	Rocky Mountain field[1]													
	Big Muddy	Cat Creek	Elk Basin, Greybull, Torchlight	Grass Creek		Hamilton Dome	Lance Creek	Lander and Simpson Ridge[2]	Lost Soldier	Mule Creek	Osage	Poison Spider	Rex-Lake	Rock Creek
				Light	Heavy									
Jan. 1	$1.33	$1.48	$1.48	$1.48	$0.90	$0.85	$1.48	$0.80	$1.00	$1.10	$1.48	$1.00	$1.10	$1.33
Jan. 25	1.28		1.36	1.36			1.38				1.38			1.18
May 21	1.43	1.65	1.65	1.65			1.68		1.05	1.20	1.65			1.40
Average for year	1.38	1.58	1.55	1.55	.90	.85	1.57	.80	1.03	1.16	1.55	1.00	1.10	1.33

Date	Rocky Mountain field—Continued																						
	Salt Creek																				Sunburst	Hogback	Florence
	Below 25°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42°–42.9°	43°–43.9°	44° and above			
Jan. 1					$0.88	$0.95	$1.02	$1.09	$1.16	$1.21	$1.26	$1.31	$1.36	$1.41	$1.46	$1.51	$1.56	$1.61	$1.66	$1.71	$1.76	$1.65	$1.48	$1.60
Jan. 25	$0.60	$0.66	$0.72	$0.78	.84	.90	.96	1.02	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44		1.53	
May 20	.85	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85			
May 21																							1.70	
May 23																						1.75		
Dec. 1																							1.60	
Average for year	.77	.82	.87	.93	.97	1.03	1.08	1.14	1.19	1.23	1.28	1.32	1.37	1.41	1.45	1.50	1.54	1.58	1.63	1.67	1.71	1.71	1.62	1.60

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[1] The Ohio Oil Co. and Midwest Refining Co.

[2] Producers and Refiners Corporation.

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Field and date of change	California[1]													
	14°–14.9°	15°–15.9°	16°–16.9°	17°–17.9°	18°–18.9°	19°–19.9°	20°–20.9°	21°–21.9°	22°–22.9°	23°–23.9°	24°–24.9°	25°–25.9°	26°–26.9°	27°–27.9°
Alamitos Heights, Huntington Beach, Inglewood, Olinda, Brea Canyon, Athens-Rosecrans, Dominguez, Torrance, Richfield:[2]														
Jan. 1	$0.85	$0.85	$0.85	$0.85	$0.85	$0.85	$0.85	$0.89	$0.93	$0.97	$1.01	$1.05	$1.09	$1.13
Jan. 18	.70	.70	.70	.70	.75	.80								
Average for year	.71	.71	.71	.71	.75	.80	.85	.89	.93	.97	1.01	1.05	1.09	1.13
Long Beach, Seal Beach:														
Jan. 1	.85	.85	.85	.85	.85	.85	.85	.89	.93	.97	1.01	1.05	1.09	1.13
Jan. 18	.70	.70	.70	.70	.75	.80								
Oct. 21	(3)	(3)	(3)	(3)	(3)	.40	.40	.40	.40	.40	.40	.60	.60	.60
Nov. 8	.70	.70	.70	.70	.75	.80	.85	.89	.93	.97	1.01	1.05	1.09	1.13
Average for year						.78	.83	.87	.90	.94	.98	1.03	1.07	1.10
Whittier-La Habra, Coyote Hills:[4]														
Jan. 1	.85	.85	.85	.85	.85	.85	.85	.88	.91	.94	.97	1.00	1.04	1.08
Jan. 18	.70	.70	.70	.70	.75	.80	.84							
Average for year	.71	.71	.71	.71	.75	.80	.84	.88	.91	.94	.97	1.00	1.04	1.08
Montebello:														
Jan. 1	.85	.85	.85	.85	.85	.85	.86	.89	.92	.95	.98	1.01	1.04	1.07
Jan. 18	.70	.70	.70	.70	.70	.75	.80	.85	.90					
Average for year	.71	.71	.71	.71	.71	.75	.80	.85	.90	.95	.98	1.01	1.04	1.07
Santa Fe Springs:														
Jan. 1								.89	.92	.95	.98	1.01	1.04	1.07
Oct. 21								.40	.40	.40	.40	.40	.40	.40
Nov. 8								.89	.92	.95	.98	1.01	1.04	1.07
Average for year								.87	.89	.92	.95	.98	1.01	1.04
Elwood Terrace:														
Jan. 1											.94	.98	1.02	1.06
Mar. 18											(3)	(3)	(3)	(3)
Average for year														

Kern River:														
Jan. 1	.50	.50	.50	.50	.50	.50								
Midway-Sunset-Elk Hills, Buena Vista Hills, Lost Hills:														
Jan. 1	.75	.75	.75	.75	.75	.75	.77	.79	.82	.86	.90	.95	1.00	1.05
Jan. 18	.50	.50	.50	.50	.56	.62	.68	.74	.80	.85				
Average for year	.51	.51	.51	.51	.57	.63	.68	.74	.80	.85	.90	.95	1.00	1.05
Newhall-McKittrick:														
Jan. 1	.75	.75	.75	.75	.75	.75								
Jan. 18	.50	.50	.50	.50	.50	.50								
Average for year	.51	.51	.51	.51	.51	.51								
Coalinga:														
Jan. 1	.75	.75	.75	.75	.75	.75	.77	.79	.82	.85	.88	.91	.94	.98
Jan. 18	.50	.50	.50	.50	.56	.62	.68	.74	.80					
Average for year	.51	.51	.51	.51	.57	.63	.68	.74	.80	.85	.88	.91	.94	.98
Wheeler Ridge:														
Jan. 1	.75	.75	.75	.75	.75	.75	.77	.79	.82	.85	.88	.91	.94	.97
Jan. 18	.50	.50	.50	.50	.56	.62	.68	.74	.80					
Average for year	.51	.51	.51	.51	.57	.63	.68	.74	.80	.85	.88	.91	.94	.97
Orcutt:														
Jan. 1	.85	.85	.85	.85	.85	.85	.85	.86	.87	.90	.93	.95	.97	
Jan. 18	.65	.65	.65	.65	.70	.70	.70				.94	.98	1.02	
Average for year	.66	.66	.66	.66	.71	.71	.71	.86	.87	.90	.94	.98	1.02	
Kettleman Hills [5]														

See footnotes at end of table.

Posted price per barrel of petroleum at wells in 1929, by grades, with dates of change—Continued

Field and date of change	California—Continued														
	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42° and above
Alamitos Heights, Huntington Beach, Inglewood, Olinda, Brea Canyon, Athens-Rosecrans, Dominguez, Torrance, Richfield:[2]															
Jan. 1	$1.17	$1.21	$1.25	$1.30	$1.35	$1.41	$1.47	$1.53	$1.59	$1.65	$1.71	$1.77	$1.83	$1.89	$1.95
Jan. 18															
Average for year	1.17	1.21	1.25	1.30	1.35	1.41	1.47	1.53	1.59	1.65	1.71	1.77	1.83	1.89	1.95
Long Beach, Seal Beach:															
Jan. 1	1.17	1.21	1.25	1.30	1.35										
Jan. 18															
Oct. 21	.60	.60	.60	.60	.60										
Nov. 8	1.17	1.21	1.25	1.30	1.35										
Average for year	1.14	1.18	1.22	1.27	1.31										
Whittier-La Habra, Coyote Hills:[4]															
Jan. 1	1.12	1.16	1.20												
Jan. 18															
Average for year	1.12	1.16	1.20												
Montebello:															
Jan. 1	1.10	1.13	1.16												
Jan. 18															
Average for year	1.10	1.13	1.16												
Santa Fe Springs:															
Jan. 1	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65			
Oct. 21	.40	.60	.60	.60	.60	.60	.60	.60	.60	.60	.60	.60			
Nov. 8	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65			
Average for year	1.07	1.12	1.17	1.22	1.27	1.31	1.36	1.41	1.46	1.50	1.55	1.60			
Elwood Terrace:															
Jan. 1	1.10	1.14	1.18	1.23	1.28	1.34	1.40	1.46	1.52	1.58	1.64	1.70	1.76	1.82	1.88
Mar. 18	(3)	(3)	(3)	(3)	(3)	(3)	1.16	1.22	1.28	1.34	1.40	1.46	1.52	1.58	1.64
Average for year							1.21	1.27	1.33	1.39	1.45	1.51	1.57	1.63	1.69

Kern River:															
Jan. 1	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Midway-Sunset-Elk Hills, Buena Vista Hills, Lost Hills:															
Jan. 1	1.10	1.16	1.22	1.28	1.34	1.40	1.46	--------	--------	--------	--------	--------	--------	--------	--------
Jan. 18	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Average for year	1.10	1.16	1.22	1.28	1.34	1.40	1.46	--------	--------	--------	--------	--------	--------	--------	--------
Coalinga:															
Jan. 1	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.30	--------	--------	--------	--------	--------	--------	--------
Jan. 18	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Average for year	1.02	1.06	1.10	1.14	1.18	1.22	1.26	1.30	--------	--------	--------	--------	--------	--------	--------
Kettleman Hills[5]	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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[1] Standard Oil Co. of California and Union Oil Co.

[2] Alamitos Heights, Huntington Beach, 14° to 32.9°; Inglewood, Torrance, 14° to 28.9°; Olinda, Brea Canyon, Richfield, 14° to 30.9°; Athens-Rosecrans, Dominguez, 24° to 42.9°.

[3] Not quoted.

[4] Whittier-La Habra, 14° to 22.9°; Coyote Hills, 14° to 30.9°.

[5] First posting, Jan. 18, 55° gravity and above, $1.65.

WELLS

During 1929 a total of 26,356 wells was drilled in the United States, of which 15,572, or 59 per cent, were oil wells; 2,870, or 11 per cent, were gas wells; and 7,914, or 30 per cent, were dry holes (see fig. 17). These figures indicate an increase in the percentage of oil wells, but a decrease in the percentage of both gas wells and dry holes. However, the percentage of oil wells completed in 1929 was considerably under the average for the period back to 1908, the first year for which the complete record is available. Since the beginning of the industry in 1859, 789,451 wells have been drilled, of which 166,776, or 21 per cent, were dry holes.

Drilling increased in 1929, and the total number of wells (26,356) completed represents an increase of 18 per cent over 1928. The gain in field activity in 1929 was largely responsible for the establishment of a new record for crude production. Drilling in 1929 reached its peak in August, when 2,662 wells were completed, and that month was the most active month for drilling since November, 1926.

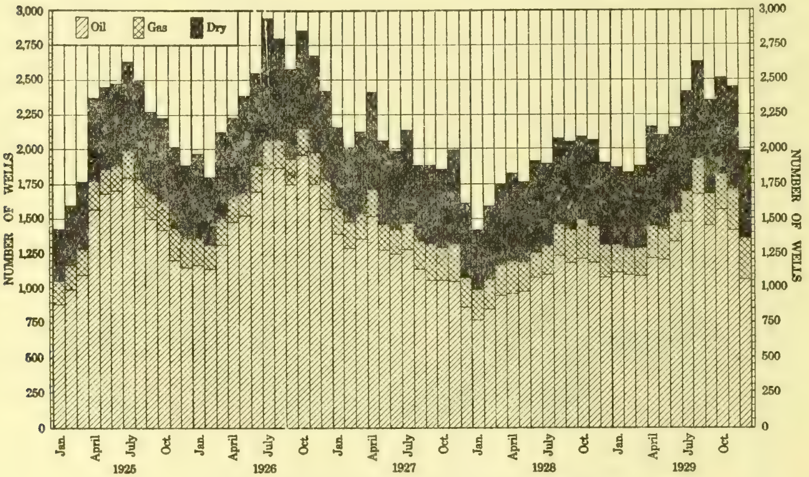

FIGURE 17.—Wells drilled, 1925-1929, by months

The total number of producing oil wells in the United States was 328,200 on December 31, 1929, compared with 327,800 at the end of 1928. Some of the States reported decline in the number of wells, but these losses were more than compensated for by gains recorded in the Eastern States. Pennsylvania continued to be the leading State in number of wells, with Oklahoma second and Ohio third. The average production per well per day was 8.4 barrels in 1929, compared with 7.6 barrels in 1928. The material increase in average for the United States was due almost entirely to increases in the averages for California and Texas. California, with only 3 per cent of the producing wells on December 31, 1929, produced 29 per cent of the total output in 1929.

As might be expected from the increase in total number of completions in 1929, the majority of the fields showed gain in 1929 in the number of wells drilled. The Santa Fe Springs field in California showed a very material increase in drilling activity in 1929 and was the most active area in the State. St. Clair County, Ill., had 252 completions in 1929, compared with only 3 in 1928; this activity followed the discovery of the Dupo field early in the year. The most active area in Kansas in 1929 was the Valley Center pool of Sedgwick County. Ohio and Daviess Counties, Ky., were again the most active areas for drilling in the State, and 80 per cent of the oil wells brought in in Kentucky in 1929 were in those counties. The Muskegon field of Michigan was rapidly drilled; it was credited with 264 oil wells in 1929, or several times the number completed in some of the more prolific fields of the country. Development work reached a high point in Ohio in 1929 and 2,570 wells were completed, compared with 1,700 in 1928. Seminole and Pottawatomie Counties, Okla., were the most active areas in the State in 1929; they, however, shared the spotlight with the Oklahoma City pool which, although it was credited with but 27 oil wells completed during the year, had the unusually high average daily initial production per well of 7,026 barrels. The Bradford district of Pennsylvania and New York continued to lead the country in oil-well completions with 2,673 in 1929, a gain of 74 per cent over 1928. The north Texas district was again the most active area for drilling in Texas, the result primarily of the shallow depth of the producing horizons and the high quality of the oil; the Refugio field was the most active area on the Texas Gulf coast; and the Pecos and Winkler fields led in west Texas. The average daily initial production of the oil wells brought in in the Pecos field of west Texas in 1929 was 7,450 barrels, which, although materially under the 1928 figure (14,055), was higher than that recorded in 1929 for any other field in the United States.

Approximate number of producing oil wells in the United States, December 31, 1927–1929

State	1927		1928		1929	
	Approximate number of wells	Average production per well per day (barrels)	Approximate number of wells	Average production per well per day (barrels)	Approximate number of wells	Average production per well per day (barrels)
Arkansas	4,550	24.2	4,520	19.3	3,900	16.2
California[1]	[1] 11,280	55.9	[1] 10,710	57.6	[1] 10,520	75.5
Colorado	170	51.7	210	39.9	220	30.0
Illinois	16,240	1.2	16,340	1.1	16,000	1.1
Indiana:						
Southwestern	1,100	1.9	1,140	2.3	1,130	2.2
Northeastern	960	.3	900	.3	820	.2
Total Indiana	2,060	1.1	2,040	1.4	1,950	1.3
Kansas	19,600	5.8	19,800	5.4	20,080	5.9
Kentucky	13,500	1.4	13,740	1.5	14,650	1.5
Louisiana:						
Gulf coast	250	56.5	320	67.6	360	60.1
Northern	4,000	12.2	3,500	10.8	3,420	10.4
Total Louisiana	4,250	14.8	3,820	14.8	3,780	14.8
Michigan	300	6.2	400	4.6	500	27.6
Montana	980	15.3	1,100	10.5	1,290	9.1
New Mexico	250	14.0	260	10.1	270	18.9
New York	16,740	.4	16,500	.4	16,800	.6

[1] American Petroleum Institute; does not include wells temporarily shut in.

Approximate number of producing oil wells in the United States, December 31, 1927–1929—Continued

State	1927		1928		1929	
	Approximate number of wells	Average production per well per day (barrels)	Approximate number of wells	Average production per well per day (barrels)	Approximate number of wells	Average production per well per day (barrels)
Ohio:						
Central and eastern	20, 100	0. 8	20, 950	0. 7	20, 720	0. 7
Northwestern	17, 500	. 3	16, 950	. 3	16, 490	. 2
Total Ohio	37, 600	. 5	37, 900	. 5	37, 210	. 5
Oklahoma	61, 750	12. 3	62, 900	11. 0	61, 180	11. 3
Pennsylvania	78, 480	. 3	78, 600	. 3	80, 220	. 4
Texas:						
Gulf coast	2, 600	50. 3	2, 850	39. 9	2, 910	47. 2
West Texas	29, 400	16. 7	2, 040	208. 9	2, 490	161. 3
Rest of State			30, 860	8. 7	30, 880	10. 1
Total Texas	32, 000	19. 5	35, 750	20. 8	36, 280	22. 6
West Virginia	19, 900	. 8	19, 600	. 8	19, 650	. 8
Wyoming	3, 560	16. 8	3, 520	16. 6	3, 530	15. 0
Other	[2] 90		[2] 90		[2] 70	
United States	323, 300	7. 7	327, 800	7. 6	328, 200	8. 4

[2] Alaska, Tennessee, and Utah.

Wells drilled for oil and gas in the United States, 1859–1929

Year	Oil		Gas		Dry		Total completed
	Number	Per cent	Number	Per cent	Number	Per cent	
1859–1907 [1]	[2] 232, 982	(2)	(2)	(2)	54, 940	19	287, 922
1908	13, 210	78	485	3	3, 214	19	16, 909
1909	13, 875	76	1, 048	5	3, 404	19	18, 327
1910	11, 018	74	1, 500	10	2, 422	16	14, 940
1911	9, 825	71	1, 580	12	2, 363	17	13, 768
1912	12, 514	73	1, 811	10	2, 855	17	17, 180
1913	19, 101	75	2, 207	8	4, 282	17	25, 500
1914	16, 668	72	2, 327	10	4, 142	18	23, 137
1915	9, 154	65	2, 022	14	2, 981	21	14, 157
1916	18, 777	76	1, 803	8	4, 039	16	24, 619
1917	16, 590	71	1, 966	8	4, 851	21	23, 407
1918	17, 845	69	2, 229	9	5, 613	22	25, 687
1919	21, 052	72	2, 135	7	5, 986	21	29, 173
1920	24, 273	71	2, 274	7	7, 364	22	33, 911
1921	14, 666	67	2, 111	9	5, 160	24	21, 937
1922	17, 333	70	2, 024	8	5, 332	22	24, 689
1923	16, 206	66	2, 349	10	5, 883	24	24, 438
1924	14, 587	67	2, 257	10	5, 044	23	21, 888
1925	16, 559	65	2, 330	9	6, 734	26	25, 623
1926	19, 013	65	2, 341	8	7, 965	27	29, 319
1927	14, 442	60	2, 491	10	7, 210	30	24, 143
1928	12, 526	56	2, 727	12	7, 078	32	22, 331
1929	15, 572	59	2, 870	11	7, 914	30	26, 356
	[2] 577, 788	(2)	[2] 44, 887	(2)	166, 776	21	789, 451

[1] Day, D. T., The Petroleum Resources of the United States: Papers on the Conservation of Mineral Resources: U. S. Geol. Survey Bull. 394, 1909, pp. 30–50.

[2] Gas wells, 1859–1907, included with oil wells.

Wells drilled for oil and gas in the United States, 1928 and 1929, by months [1]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	The year	
													Total	Percentage
1928														
Oil	765	849	946	962	970	1,060	1,093	1,233	1,185	1,206	1,187	1,070	12,526	56
Gas	212	210	221	230	213	198	212	229	231	284	258	229	2,727	12
Dry	444	530	556	634	588	658	590	620	637	595	621	605	7,078	32
	1,421	1,589	1,723	1,826	1,771	1,916	1,895	2,082	2,053	2,085	2,066	1,904	22,331	100
1929														
Oil	1,111	1,090	1,081	1,216	1,200	1,318	1,426	1,669	1,438	1,556	1,407	1,060	15,572	59
Gas	191	186	199	230	231	218	263	252	237	258	300	305	2,870	11
Dry	557	557	598	717	665	623	722	741	680	701	743	610	7,914	30
	1,859	1,833	1,878	2,163	2,096	2,159	2,411	2,662	2,355	2,515	2,450	1,975	26,356	100

[1] California dry gas wells not reported.

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts [1]

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Arkansas:					
Nevada	4		2	6	20
Ouachita	54	1	19	74	94
Union	45	14	66	125	321
Miscellaneous		4	36	40	
	103	19	123	245	190
Total, 1928	157	29	178	364	491
California:					
Capitan	1	(2)		1	150
Coalinga	1			1	45
Coyote	3		2	5	125
Dominguez	1			1	3,114
Elwood-Goleta	18		8	26	3,772
Fruitvale	16		1	17	542
Fullerton	4		1	5	209
Huntington Beach	20		11	31	134
Inglewood	5			5	347
Kern River	40		8	48	210
Kettleman Hills	3		1	4	2,672
Lawndale	6		57	63	425
Long Beach	192		15	207	847
Lost Hills-Belridge	20		1	21	29
McKittrick	1		2	3	175
Midway-Sunset	86		17	103	486
Montebello	4		2	6	104
Mount Poso	61		7	68	189
Playa del Rey	1			1	2,250
Potrero	10		6	16	365
Richfield	25		6	31	240
Rincon	8		8	16	246
Rosecrans	6		10	16	642
Round Mountain	13		2	15	290
Santa Barbara	3		26	29	423
Santa Fe Springs	276		6	282	3,150
Santa Maria	2			2	225
Seal Beach	19		6	25	994
Summerland	7		3	10	155
Ventura Avenue	51			51	1,425
Ventura-Newhall	7		10	17	111
Miscellaneous			98	98	
	910	(2)	314	1,224	1,437
Total, 1928	712	(2)	191	903	957

[1] For States east of California, Oil and Gas Journal; for California, American Petroleum Institute.
[2] California dry gas wells not reported.

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Colorado:					
Fremont	19		19	38	57
Larimer	3		2	5	354
Moffat	6	1	1	8	366
Routt	5		6	11	110
Miscellaneous		4	32	36	
	33	5	60	98	148
Total, 1928	69	1	70	140	200
Illinois:					
Clark	5		8	13	12
Crawford	41	2	10	53	13
Lawrence	19		8	27	65
St. Clair	225		27	252	58
Saline	1		2	3	80
Wabash	22		25	47	44
Miscellaneous	1		7	8	2
	314	2	87	403	51
Total, 1928	76	8	53	137	22
Indiana:					
Northeastern—					
Adams	10		1	11	15
Miscellaneous		8	4	12	
	10	8	5	23	15
Total, 1928	10	16	23	49	10
Southwestern—					
Daviess	3	2	3	8	27
Gibson	6	12	15	33	19
Perry	1		6	7	15
Pike	19	10	7	36	33
Spencer	10		23	33	22
Sullivan	6	3	9	18	14
Vigo	10			10	52
Miscellaneous	2	1	10	13	6
	57	28	73	158	29
Total, 1928	76	22	59	157	31
Total Indiana—					
1929	67	36	78	181	27
1928	86	38	82	206	28
Kansas:					
Anderson	13	2	3	18	39
Butler	72		47	119	127
Chase	4		1	5	23
Chautauqua	15	5	12	32	33
Cowley	23	17	36	76	209
Edwards	1		1	2	40
Elk	19	1	16	36	100
Ellis	11		13	24	246
Greenwood	113	2	62	177	163
Lyon	2		7	9	84
McPherson	15	2	15	32	777
Marion	13	1	14	28	122
Ness	1		1	2	185
Rice	1		2	3	150
Russell	22		7	29	109
Sedgwick	151	4	87	242	677
Sumner	16	1	16	33	501
Trego	1			1	164
Miscellaneous	60	17	113	190	15
	553	52	453	1,058	299
Total, 1928	587	115	455	1,157	172

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Kentucky:					
Allen	16		24	40	4
Barren	11	4	9	24	13
Breckinridge	3		1	4	9
Christian	2			2	10
Daviess	225	6	113	344	44
Hancock	5	9	8	22	15
Henderson	21		1	22	52
Hopkins	2	6	3	11	30
Johnson-Magoffin	23		2	25	10
McLean	8		5	13	12
Muhlenberg	9		9	18	231
Ohio	491	33	180	704	73
Warren	19	2	12	33	5
Webster	4	4		8	21
Miscellaneous	58	18	38	114	5
	897	82	405	1,384	56
Total, 1928	871	48	424	1,343	41
Louisiana:					
Gulf coast—					
Anse la Butte	1		5	6	500
Bayou Bouillon	4		9	13	656
Edgerley	15		4	19	325
Hackberry	49		28	77	500
Jennings	15		12	27	138
Lockport	14	3	5	22	422
Starks	3		8	11	77
Sulphur	14		12	26	1,800
Sweet Lake	1		1	2	80
Vinton	24		9	33	341
Miscellaneous	15	3	99	117	498
	155	6	192	353	527
Total, 1928	138	4	155	297	615
Northern—					
Bossier	6	22	14	42	133
Caddo	86	7	65	158	187
De Soto	2	3	18	23	55
La Salle	21	1	12	34	12
Red River	5	2	3	10	20
Sabine	11		7	18	905
Webster	11	23	8	42	79
Winn	5		1	6	74
Miscellaneous		223	56	279	
	147	281	184	612	201
Total, 1928	64	229	235	528	165
Total Louisiana—					
1929	302	287	376	965	368
1928	202	233	390	825	472
Michigan:					
Isabella	68	1	13	82	256
Mason	1	2	1	4	92
Midland	13		9	22	442
Muskegon	264	23	60	347	396
Saginaw	2			2	15
Miscellaneous		5	41	46	
	348	31	124	503	368
Total, 1928	99	29	26	154	200
Montana:					
Cat Creek	1			1	25
Kevin-Sunburst	113	40	62	215	39
Liberty	1	2	3	6	36
Pondera	81		3	84	88
Teton	17		7	24	16
Miscellaneous		24	19	43	
	213	66	94	373	56
Total, 1928	183	56	120	359	124

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
New Mexico:					
Eddy	11	2	17	30	266
Lea	19	14	24	57	492
San Juan	2		5	7	403
Miscellaneous			25	25	
	32	16	71	119	408
Total, 1928	15	6	45	66	148
Ohio:					
Central and eastern—					
Ashland	86	76	101	263	14
Coshocton	49	12	5	66	31
Guernsey	56	23	34	113	44
Hocking	53	7	18	78	37
Holmes	29	38	15	82	25
Knox	9	32	16	57	52
Licking	206	33	21	260	27
Medina	39	19	22	80	14
Monroe	43	8	19	70	11
Muskingum	56	35	33	124	83
Perry	80	47	11	138	64
Miscellaneous	303	446	299	1,048	10
	1,009	776	594	2,379	27
Total, 1928	660	496	340	1,496	34
Northwestern—					
Allen	26		3	29	20
Auglaize	4		1	5	8
Hancock	28	6	1	35	24
Mercer	7		1	8	12
Sandusky	12	3	3	18	26
Seneca	19	12	17	48	94
Shelby	2			2	23
Van Wert	2			2	10
Wood	22		9	31	11
Miscellaneous	4	4	5	13	5
	126	25	40	191	30
Total, 1928	130	19	55	204	47
Total Ohio—					
1929	1,135	801	634	2,570	27
1928	790	515	395	1,700	36
Oklahoma:					
Caddo	4		6	10	311
Carter	54	7	20	81	116
Cotton	39	2	34	75	94
Creek	175	34	141	350	73
Grady	2	19	9	30	100
Grant	4	5	5	14	285
Hughes	25	17	24	66	226
Jefferson	12		13	25	93
Kay	8	17	31	56	202
Kiowa	9	1	51	61	22
Lincoln	2	4	17	23	83
Logan	22	3	9	34	2,183
Marshall	8	2	12	22	56
Muskogee	48	25	85	158	40
Nowata	15	2		17	11
Okfuskee	77	19	51	147	143
Oklahoma	27	5		32	7,026
Okmulgee	73	23	68	164	32
Osage	158	35	91	284	113
Pawnee	43	5	24	72	110
Payne	12	3	13	28	474
Pontotoc	60	7	19	86	237
Pottawatomie	427	11	114	552	727
Seminole	536	44	176	756	987
Stephens	104	17	86	207	81
Wagoner	20	25	52	97	22
Miscellaneous	35	37	94	166	10
	1,999	369	1,245	3,613	590
Total, 1928	1,961	491	1,227	3,679	518

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Pennsylvania and New York:					
Allegany	405		1	406	2
Bradford	2,673	1	5	2,679	2
Butler-Armstrong	112	17	39	168	2
Middle Field	67	1	2	70	3
Venango-Clarion	383	47	24	454	2
Southwestern Pennsylvania	150	50	32	232	10
	3,790	116	103	4,009	2
Total, 1928	2,373	169	104	2,646	2
Tennessee:					
Clay, Decatur, Dickson, and Madison	4		4	8	30
Total, 1928	41	7	18	66	77
Texas:					
Gulf coast—					
Barbers Hill	71		21	92	1,204
Batson	32		10	42	15
Big Creek	24	1	7	32	1,652
Blue Ridge	35		8	43	529
Boling	10	1	28	39	160
Clay Creek	14	4	11	29	875
Dewalt	48		1	49	741
Goose Creek	17		7	24	77
High Island	8		4	12	792
Hull	57	2	14	73	407
Humble	41		16	57	1,419
Liberty	77		34	111	432
Nash	2		3	5	600
North Dayton	2	1	3	6	1,863
Orange	23		7	30	105
Orchard	1		3	4	800
Pierce Junction	70	2	18	90	783
Raccoon Bend	79	4	18	101	363
Refugio	78	36	22	136	367
Saratoga	11		4	15	33
Sourlake	16		3	19	42
Spindletop	99		32	131	568
West Columbia	4		3	7	491
Miscellaneous	47	7	179	233	568
	866	58	456	1,380	603
Total, 1928[3]	645	43	483	1,171	540
Rest of State—					
North, central, eastern, and southwestern—					
Anderson	7	5	23	35	346
Archer	264		337	601	54
Brown	179	12	219	410	94
Callahan	40	2	82	124	42
Cherokee	3		6	9	533
Coleman	108	28	159	295	214
Cooke	89		64	153	222
Darst Creek	6		2	8	1,282
Eastland	56	18	108	182	79
Foard	6	1	4	11	102
Haskell	5		9	14	57
Hill	3		11	14	11
Jack	53	4	31	88	198
Luling	5			5	21
Marion	2			2	83
Mirando	105	79	105	289	146
Montague	40	1	17	58	37
Palo Pinto	8	14	21	43	53
Panola	1	57	10	68	25
Salt Flat (Bruner)	288	3	46	337	406
Shackelford	142	5	173	320	86
Stephens	23	23	47	93	40
Throckmorton	8	3	19	30	25
Van Zandt	4		6	10	1,843
Wichita	294		200	494	67
Wilbarger	394		147	140	154

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[3] Revised figures.

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Texas—Continued.					
Rest of State—Continued.					
North, central, eastern, and southwestern—Continued.					
Yoast	20	----------	7	27	378
Young	222	----------	277	499	69
Miscellaneous	133	115	490	738	306
	2,508	370	2,620	5,498	158
Total, 1928[3]	2,190	402	2,212	4,804	120
Panhandle—					
Carson	42	21	7	70	322
Gray	224	24	29	277	1,097
Hutchinson	69	9	1	79	219
Moore	15	8	4	27	296
Miscellaneous	1	77	29	107	195
	351	139	70	560	795
Total, 1928	207	100	89	396	329
West Texas:					
Crane	35	----------	3	38	294
Crockett	6	----------	15	21	116
Ector	1	----------	----------	1	365
Fisher	7	----------	19	26	226
Garza	5	----------	3	8	32
Glasscock	16	----------	19	35	802
Howard	209	----------	24	233	439
Irion	1	----------	19	20	15
Jones	36	----------	37	73	153
Loving	11	----------	1	12	736
Mitchell	4	2	14	20	79
Pecos	144	7	95	246	7,450
Reagan	22	----------	6	28	249
Taylor	1	----------	10	11	336
Upton	16	----------	3	19	312
Ward	19	1	5	25	205
Winkler	182	2	24	208	3,665
Miscellaneous	----------	----------	92	92	----------
	715	12	389	1,116	2,638
Total, 1928	938	13	307	1,258	5,917
Total "Rest of State"—					
1929	3,574	521	3,079	7,174	717
1928[3]	3,335	515	2,608	6,458	1,764
Total Texas—					
1929	4,440	579	3,535	8,554	695
1928	3,980	558	3,091	7,629	1,565
Utah:					
Grand	----------	----------	3	3	----------
Uintah	----------	----------	2	2	----------
Miscellaneous	----------	----------	3	3	----------
	----------	----------	8	8	----------
Total, 1928	----------	5	7	12	----------
West Virginia:					
Boone	11	67	2	80	10
Calhoun	31	57	8	96	11
Clay	19	3	1	23	13
Gilmer	19	24	9	52	10
Jackson	19	----------	3	22	19
Mingo	2	14	----------	16	9
Ritchie	84	22	28	134	9
Roane	67	12	7	86	22
Wetzel-Tyler	23	16	7	46	10
Miscellaneous	75	184	67	326	4
	350	399	132	881	11
Total, 1928	200	404	131	735	12

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[3] Revised figures.

Wells drilled for oil and gas in the United States in 1929, by States and by counties or districts—Continued

State and county or district	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Wyoming:					
Big Horn	1	2	2	5	90
Carbon	3	2	5	10	83
Hot Springs	1		2	3	50
Johnson	1		1	2	130
Natrona—Salt Creek	36		1	37	651
Natrona (other than Salt Creek)	6		1	7	117
Park	13		12	25	575
Sublette	9		6	15	115
Sweetwater	1	4	2	7	1,100
Uinta	2		2	4	33
Weston	8		3	11	68
Miscellaneous	1	1	7	9	5
	82	9	44	135	425
Total, 1928	124	14	65	203	218
Other States:					
1929 [4]		1	24	25	
1928 [4]		1	6	7	
United States:					
1929	15,572	[2] 2,870	7,914	[2] 26,356	396
1928	12,526	[2] 2,727	7,078	[2] 22,331	668

[2] California dry gas wells not reported.

[4] Alabama and Mississippi.

GRAVITY OF CRUDE PETROLEUM

The gravity of the various grades of crude oil produced in the United States ranges from a low of 6.8° A. P. I. for the crude from the Casmalia field of California to 65° A. P. I. for the crude from the Rattlesnake field of New Mexico. The gravity of the crude from the celebrated Kettleman Hills field of California averages 60° A. P. I., or approximately the same as that of the average grade of gasoline. Although a detailed survey of the gravity of domestic crudes has not been made since late in 1928,[3] it is quite certain that the average gravity of the crude produced in 1929 was higher than of that produced in 1928.

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[3] Hopkins, G. R., and Coons, A. B., Survey of Gravities of Domestic Crudes: Inf. Circ. 6114, Bureau of Mines, 1929, 26 pp.

Estimated average gravity of crude petroleum from various fields in the United States in 1929

District or grade	Degrees A. P. I.	Specific gravity
Alaska: Katalla	44.0	0.806
Arkansas:		
Bradley	26.4	.896
Champagnolle	29.5	.879
El Dorado	34.4	.853
Irma	14.4	.970
Lisbon	34.0	.855
Smackover—		
Heavy	19.8	.935
Light	25.9	.899
Stephens	29.0	.882
California:		
Casmalia	6.8	1.028
Cat Canyon	15.9	.960
Coalinga	19.4	.938
Coyote	25.0	.904
Dominguez	31.0	.871
Elk Hills	22.5	.919
Elwood	37.5	.837
Fruitvale	23.7	.912
Fullerton	22.4	.919
Goleta	42.0	.816
Huntington Beach	25.6	.901
Inglewood	18.4	.944
Kern River	14.1	.972
Kettleman Hills	60.0	.739
Lawndale	35.0	.850
Long Beach	25.8	.900
Los Angeles	15.5	.963
Lost Hills-Belridge	25.5	.901
McKittrick	14.8	.967
Midway-Sunset	19.0	.940
Montebello	23.0	.916
Mount Poso	15.5	.963
Newhall	22.0	.922
Newport Beach	12.3	.984
Playa del Rey	22.5	.919
Potrero	48.5	.786
Richfield	22.3	.920
Rincon	30.0	.876
Rosecrans	37.8	.836
Round Mountain	18.2	.945
Salt Lake	14.8	.967
Santa Fe Springs	33.2	.859
Santa Maria	23.0	.916
Seal Beach	24.2	.909
Summerland	13.6	.975
Torrance	20.7	.930
Ventura Avenue	30.2	.875
Wheeler Ridge	25.3	.902
Whittier	19.1	.940
Colorado:		
Canon City	32.0	.865
Florence	29.3	.880
Fort Collins	37.0	.840
Iles Dome	35.0	.850
Moffat	41.0	.820
Rangely	42.5	.813
Tow Creek	35.0	.850
Walden	51.0	.775
Illinois:		
Dupo	30.0	.876
"Illinois"	31.5	.868
Plymouth	34.2	.854
Waterloo	30.0	.876
Indiana:		
Northeastern ("Indiana")	35.5	.847
Southwestern ("Princeton")	33.0	.860
Kansas:		
Anderson	35.0	.850
Augusta	34.0	.855
Big Sandy	23.0	.916
Churchill	36.0	.845
Eldorado	36.0	.845
Iola	19.0	.940
Leon-Weaver	34.0	.855
Lost Springs	37.0	.840
Rainbow	39.0	.830
Kansas—Continued.		
Russell County	39.0	0.830
Sedgwick	42.5	.813
Seely	40.0	.825
Sumner County	38.0	.835
Teeter	36.8	.841
Virgil	38.0	.835
Voshell	41.5	.818
Winfield	38.0	.835
Kentucky:		
Daviess County	35.8	.843
Ohio County	35.0	.850
Ragland	23.2	.915
Rodemer	29.0	.882
Scottsville	35.0	.850
Somerset	37.6	.837
Warren County	36.0	.845
Wayne	37.6	.837
Louisiana:		
Gulf coast (salt domes)—		
Anse la Butte	24.0	.910
Bayou Bleu	21.8	.923
Bayou Bouillon	30.2	.875
Black Bayou	24.0	.910
Edgerley	21.0	.928
Hackberry	21.0	.928
Jennings	24.3	.908
Lake Barre	29.0	.893
Lake Pelto	17.0	.953
Lockport	24.8	.905
Port Barre	26.0	.898
Sorrento	26.2	.897
Starks	21.0	.928
Sulphur	20.9	.929
Sweet Lake	29.5	.879
Vinton	18.6	.943
Welsh	22.0	.922
White Castle	28.0	.887
Rest of State—		
Bellevue	19.0	.940
Bull Bayou	39.5	.828
Caddo—		
Heavy	26.5	.896
Light	40.1	.825
Cotton Valley	29.0	.882
De Soto	36.0	.845
Elm Grove	29.5	.879
Haynesville	35.0	.850
Homer	36.2	.844
Pleasant Hill	39.6	.827
Urania	21.0	.928
Zwolle	39.6	.827
Michigan:		
Mount Pleasant	43.0	.811
Muskegon	38.4	.833
Saginaw	40.0	.825
Montana:		
Bannatyne	27.0	.893
Cat Creek	49.7	.781
Elk Basin	42.0	.816
Kevin-Sunburst	31.9	.866
Lake Basin	44.0	.806
Pondera	34.0	.855
New Mexico:		
Artesia	37.0	.840
Hobbs	35.0	.850
Hogback	56.0	.755
Hospah	30.0	.876
Maljamar	33.0	.860
Rattlesnake	65.0	.720
Table Mesa	57.0	.751
New York	43.5	.809
Ohio:		
Northwestern ("Lima")	36.6	.842
Southeastern and central—		
Cleveland	38.2	.834
Corning	40.0	.825
Pennsylvania grade	42.5	.813
Wooster	38.1	.834

Estimated average gravity of crude petroleum from various fields in the United States in 1929—Continued

District or grade	Degrees A. P. I.	Specific gravity
Oklahoma:		
Allen	29.7	0.878
Bowlegs	39.5	.828
Braman	41.0	.820
Bristow	34.0	.855
Burbank	37.6	.837
Cement	34.6	.852
Cromwell	38.0	.835
Cushing	39.4	.828
Davenport	43.2	.810
Duncan	35.4	.848
Earlsboro	40.0	.825
Fox	23.6	.912
Garber	45.6	.799
Glenn	34.0	.855
Graham	38.0	.835
Healdton	30.0	.876
Hewitt	33.5	.858
Little River	38.0	.835
Lovell-Marshall	40.5	.823
Oklahoma City	38.5	.832
Papoose	38.0	.835
Pearson	38.0	.835
Ponca	40.0	.825
St. Louis	40.0	.825
Searight	38.2	.834
Seminole City	39.0	.830
Sholem-Alechem	32.0	.865
Thomas	42.0	.816
Tonkawa	42.0	.816
Walters	33.3	.859
Wewoka	38.5	.832
Wheeler	21.7	.924
Pennsylvania:		
Bradford	43.5	.809
Franklin	29.5	.879
"Pennsylvania"	40.0	.825
Tennessee:		
Glen Mary	39.0	.830
Tinsleys Bottom	43.2	.810
Texas:		
Gulf coast (salt domes)—		
Barbers Hill	26.2	.897
Batson	20.6	.930
Bernard	28.0	.887
Big Creek	27.0	.893
Blue Ridge	30.0	.876
Boling	29.1	.881
Clay Creek	25.5	.901
Damon Mound	22.1	.921
Dayton	30.0	.876
Esperson	21.7	.924
Fannette	31.8	.867
Goose Creek	24.0	.910
Hankamer	24.3	.908
High Island	28.0	.887
Hull	25.0	.904
Humble	19.4	.938
Kingsville	21.5	.925
Lost Lake	21.0	.928
Markham	26.3	.897
Moore	34.5	.852
Mykawa	27.0	.893
Nash	20.0	.934
Orange	23.7	.912
Pierce Junction	23.5	.913
Port Neches	21.5	.925
Raccoon Bend	25.5	.901
Refugio	24.0	.910
Saratoga	19.0	.940
Sourlake	26.0	.898
South Liberty	22.3	.920
Spindletop	26.0	.898
Sugarland	28.0	.887
West Columbia	22.8	.917
Texas—Continued.		
Rest of State—		
East and south central—		
Boggy Creek	39.0	0.830
Calliham	18.0	.947
Corsicana	34.0	.855
Currie	42.0	.816
Darst Creek	35.5	.847
Luling	26.8	.894
Lytton Springs	38.0	.835
Mexia	35.6	.847
Minerva	38.5	.832
Nigger Creek	38.5	.832
Pettus	45.0	.802
Powell	37.5	.837
Salt Flat (Bruner)	35.0	.850
Somerset	34.0	.855
Thrall	37.6	.837
Van	34.0	.855
Wortham	38.5	.832
North and central—		
Brownwood	34.0	.855
Burkburnett	37.4	.838
Cooke County	40.7	.822
Desdemona	37.2	.839
Electra	40.2	.824
Nocona	22.0	.922
Noodle Creek	40.5	.823
Petrolia	36.8	.841
Ranger	37.0	.840
Panhandle	35.8	.846
Southwest—		
Albercas	23.0	.916
Bruni	18.0	.947
Hondo	19.0	.940
Mirando	23.0	.916
Randado	21.0	.928
West Texas—		
Big Lake	38.2	.834
Chalk	31.3	.869
Church-Fields	31.0	.871
Ector	33.5	.858
Hendricks	30.0	.876
McCamey	28.0	.887
McElroy	32.0	.865
Taylor-Link	30.0	.876
Ward	35.0	.850
Westbrook	25.0	.904
World	29.7	.878
Yates	30.0	.876
West Virginia:		
Cabin Creek	47.0	.793
Kellys Creek	45.6	.799
"Pennsylvania"	42.7	.812
Somerset	39.4	.828
Wyoming:		
Big Muddy	32.4	.863
Dutton Creek	33.6	.857
Elk Basin	42.0	.816
Ferris	36.6	.842
Grass Creek	44.0	.806
Greybull	44.7	.803
Hamilton Dome	25.2	.903
La Barge	30.0	.876
Lance Creek	40.4	.823
Lander	23.4	.914
Lost Soldier	30.2	.875
Mule Creek	31.7	.867
Oregon Basin	22.0	.922
Osage	37.6	.837
Pilot Butte	35.4	.848
Rex Lake	32.3	.864
Rock Creek	36.4	.843
Salt Creek	36.8	.841

PRODUCTION OF PETROLEUM AND ROYALTIES FROM WELLS UNDER FEDERAL CONTROL

The following tables were compiled from data received by the United States Geological Survey and the Office of Indian Affairs.

The production of crude petroleum on Government lands in 1929 amounted to 31,682,687.07 barrels, of which 4,526,903.99 barrels, valued at $5,042,938.69, was royalty oil. All three of these figures represent declines from 1928, although the decreases were not as marked as those in the previous year. The most important producing districts under Federal control are in California and Wyoming; production on Government lands in these two States in 1929 amounted to 29,338,768.74 barrels, or 93 per cent of the total.

A very material decline in the leasing of Indian lands occurred in 1929; the number of acres leased fell from 203,977 in 1928 to 143,576 in 1929, and the bonus from the sale of leases declined from $4,562,592 in 1928 to $2,759,291 in 1929. The royalty from production was also lower in 1929, but the decrease was much less than that in 1928. Slightly more than half of the total royalty from production on Indian lands in 1929 was paid to the Osage Indians.

Crude petroleum produced on Government lands, 1928 and 1929, under the operation of the leasing act of February 25, 1920

[From U. S. Geological Survey]

State and land office	1928			1929		
	Production (barrels)	Royalty		Production (barrels)	Royalty	
		Barrels	Value		Barrels	Value
California:						
Los Angeles	1,318,893.39	163,915.24	$141,573.77	1,795,505.38	219,831.26	$198,751.80
Sacramento (including Visalia), outside naval reserves	4,074,008.85	565,687.85	452,933.20	6,267,912.18	702,742.50	590,544.93
Sacramento (including Visalia), inside naval reserves	8,889,360.34	2,106,800.41	1,796,162.41	7,443,647.34	1,615,922.05	1,380,594.52
	14,282,262.58	2,836,403.50	2,390,669.38	15,507,064.90	2,538,495.81	2,169,891.25
Colorado: Denver	1,027,408.09	90,090.82	53,003.03	852,796.12	57,739.23	43,499.66
Louisiana: Baton Rouge	8,573.60	893.86	1,681.10	7,409.21	757.40	1,572.87
Montana:						
Billings	504,057.38	29,973.76	54,592.09	405,941.62	23,490.24	57,724.89
Great Falls	188,216.96	11,035.96	18,810.38	150,209.51	9,392.91	17,182.72
	692,274.34	41,009.72	73,402.47	556,151.13	32,883.15	74,907.61
New Mexico:						
Las Cruces	83,159.97	15,035.48	14,776.76	496,735.68	62,876.43	62,138.76
Santa Fe	518.29	103.66	131.92	957.10	191.42	258.13
	83,678.26	15,139.14	14,908.68	497,692.78	63,067.85	62,396.89
Oklahoma: Guthrie	546,027.22	83,321.74	132,569.39	426,589.24	57,802.61	96,013.21
Utah: Salt Lake City	3,522.20	413.01	544.07	3,279.85	367.84	473.20
Wyoming:						
Buffalo	53,124.31	5,345.36	7,587.42	80,475.54	6,145.99	9,127.13
Cheyenne, outside naval reserves	14,933,724.48	2,131,677.51	2,678,587.00	12,943,077.24	1,698,874.97	2,519,889.92
Evanston	502,295.01	37,813.73	26,770.13	808,151.06	70,769.14	65,166.95
	15,489,143.80	2,174,836.60	2,712,944.55	13,831,703.84	1,775,790.10	2,594,184.00
	32,132,890.09	5,242,108.39	5,379,722.67	31,682,687.07	4,526,903.99	5,042,938.69

Royalty receipts from production of oil and gas and bonuses paid for sale of leases on Indian reservations, fiscal years ended June 30, 1928 and 1929

[From Office of Indian Affairs]

Reservation	1928			1929		
	Oil and gas land leased during year (acres)	Receipts		Oil and gas land leased during year (acres)	Receipts	
		Bonus from sale of leases	Royalty from production		Bonus from sale of leases	Royalty from production
Blackfeet				3,330	$25	
Five Civilized Tribes: Oil	58,810	$197,727	$4,349,792	57,797	207,648	$4,350,108
Cheyenne and Arapaho: Oil	15,559	30,029		15,263	69,809	
Chippewa	1,520					
Crow	2,848	[1] 267		12,488	380	
Kiowa:						
Oil	29,693	33,921	10,041	674		53,875
Gas			6,512			
Navajo (eastern): Oil	640	2,936				
Navajo (northern): Oil			67,259	1,440	216	104,175
Osage:						
Oil	81,840	4,228,681	5,030,247	46,257	[2] 2,420,692	3,857,742
Gas			1,081,132			1,068,026
Pawnee: [3]						
Oil	2,020	17,368	85,044	3,189	27,804	72,170
Gas			13,339			
Pottawatomie	4,780	677		(4)	(4)	(4)
Shawnee:						
Oil	1,307	50,986	41,077	[4] 3,138	[4] 32,717	[4] 151,203
Gas			1,124			
Shoshone: Oil			15,628			8,653
Sioux	4,960					
Ute: Oil			86			
	203,977	4,562,592	10,701,281	143,576	2,759,291	9,665,952

[1] Incomplete.
[2] Includes deferred payments.
[3] Includes Kaw, Otoe, Ponca, Tonkawa.
[4] Pottawatomie included with Shawnee.

STATE CRUDE PRODUCTION TAXES[4]

Oklahoma.—3 per cent of gross value, less royalty interest.

Texas.—2 per cent of gross value.

Louisiana.—From 4 to 11 cents a barrel, depending upon gravity.

Arkansas.—2.6 per cent of gross market value.

Montana.—2 per cent of gross value at well.

Wyoming and New Mexico.—Production tax based upon State and county assessments.

California.—0.66443 mill per barrel of oil produced and 17.39 cents per acre on proved oil lands.

SUMMARY OF REFINERY STATISTICS

Runs of crude petroleum to stills in 1929 totaled 987,708,000 barrels, an increase of 8 per cent over 1928. Of the total, 912,191,000 barrels, or 92 per cent, was domestic crude oil and 75,517,000 barrels, or 8 per cent, was foreign crude oil. Compared with 1928, these data represent a gain of 76,480,000 barrels in the use of domestic crude oil, but a decline of slightly more than 2,000,000 barrels in the use of foreign crudes. Daily average runs to stills in January, 1929, were below those in December, 1928, but from February 1 to July 1 they increased steadily. A recession in refining activity occurred in July, but August, September, and October witnessed a steady gain in crude oil processed.

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[4] Oil Weekly, Dec. 5, 1930, p. 66.

The production of motor fuel in the United States during 1929 amounted to 439,393,000 barrels (18,454,506,000 gallons), of which 435,078,000 barrels was produced as "gasoline" at refineries; this represents an increase in motor fuel production of 15 per cent over 1928. As noted above, the increase in crude runs to stills was 8 per cent; hence the additional 7 per cent gain resulted from a gain in percentage recovery from 41.3 per cent in 1928 to 44 per cent in 1929. A part of this gain in percentage yield resulted from the material increase in the quantity of natural gasoline blended. With the natural-gasoline factor eliminated, the gain in recovery was close to 2 per cent, or the equivalent of 37.4 to 39.3 per cent of the crude oil run. California reported the largest increase in gasoline recovery in 1929; the percentage in that State rose to 38 per cent from 32 per cent in 1928. A part of the increased yield of gasoline in 1929 was due to a gain in cracking activity. The total production of cracked gasoline in 1929 amounted to 143,727,000 barrels, a gain of 17 per cent over 1928.

A material factor in the gasoline supply was the increase in imports from 4,198,000 barrels in 1928 to 8,834,000 barrels in 1929. From a purely domestic standpoint the rapid growth in shipments of California gasoline through the Panama Canal to the Atlantic seaboard was also very important.

The indicated domestic demand for motor fuel in 1929 amounted to 375,999,000 barrels, an increase of 43,966,000 barrels, or 13 per cent, over 1928. Exports increased from 53,412,000 barrels in 1928 to 62,059,000 barrels in 1929, a gain of 16 per cent. The trend of motor-fuel stocks in 1929 was somewhat different from that in 1928. The peak stocks of March 31, 1929, were considerably higher than those on the corresponding date in 1928, and, although the heavy summer demand reduced these stocks to as low as 24 days' supply on August 31, the continued record-breaking output carried over into the fall months caused a rapid accumulation of stocks during the last quarter of the year. Thus, the total on hand on December 31, 1929—43,261,000 barrels—was more than 10,000,000 barrels above the quantity held on the first day of the year.

The percentage yield of kerosene continued to decline and fell from 6.5 per cent in 1928 to 5.7 per cent in 1929. Exports declined slightly more than 2,000,000 barrels, but the indicated domestic demand was practically the same as in 1928.

The production of gas oil and fuel oil in 1929 amounted to 448,949,000 barrels, a recovery of 45.5 per cent from the crude processed, compared with a recovery of 46.8 per cent in 1928. The percentage yield of both kerosene and fuel oil has declined steadily in recent years; the net decrease in 1929 was comparable with the increase in recovery of gasoline. Imports of fuel oil showed a rapid increase, beginning in March, and the total of 20,545,000 barrels for the year was 183 per cent higher than the 1928 figure. Stocks of gas oil and fuel oil east of California declined 501,000 barrels in 1929, but stocks in California, which include heavy crude, rose from 99,218,000 barrels on January 1 to 112,406,000 barrels on December 31.

The production of lubricants recorded a small decline in 1929 and, because of the increased runs to stills, the percentage yield dropped materially—from 3.8 per cent in 1928 to 3.5 per cent in 1929.

Exports of lubricants were lower but the indicated domestic demand was higher.

The statistical record for paraffin wax in 1929 was practically the reverse of that in 1928. In 1928 production, exports, and indicated domestic demand increased materially over 1927 and stocks were reduced, whereas in 1929 production remained virtually the same as in 1928, exports and indicated domestic demand fell off 19 and 9 per cent, respectively, and stocks increased nearly 80,000,000 pounds, or 70 per cent.

Refinery statistics, 1925–1929

[Thousands of barrels of 42 U. S. gallons except as otherwise indicated]

	1925	1926	1927	1928	1929
Crude oil run to stills:					
Domestic	698,582	734,301	778,729	835,711	912,191
Foreign	41,338	44,963	50,106	77,584	75,517
	739,920	779,264	828,835	913,295	987,708
Natural gasoline run to stills or blended at refineries	[1] 19,636	[1] 27,696	[1] 32,162	[1] 35,223	[1] 46,457
Stocks of crude oil (domestic and foreign) at refineries at end of year	[2] 27,157 [3] 29,200	[2] 35,475	[2] 39,317	[2] 40,529	[2] 46,195
Gasoline:					
Produced	259,601	299,734	330,435	376,945	435,078
Imported	3,813	5,540	5,002	4,198	8,834
Exported [4]	31,497	43,313	44,337	52,904	61,265
Domestic demand	223,865	261,813	296,807	328,489	372,468
Stocks at refineries at end of year	38,875	39,023	33,316	33,066	43,245
Kerosene:					
Produced	59,689	61,768	56,113	59,353	55,940
Imported	19	74	55	202	208
Exported [4]	21,212	22,248	19,537	22,034	20,022
Domestic demand	39,969	38,140	37,491	36,235	36,032
Stocks at refineries at end of year	7,121	8,575	7,715	9,001	9,095
Gas oil and fuel oil:					
Produced	364,991	365,195	393,066	427,237	448,949
Imported	12,245	14,432	8,124	7,268	20,545
Exported [4]	36,088	38,351	47,391	44,427	39,151
Domestic demand	(5)	(5)	(5)	(5)	(5)
Stocks at refineries at end of year	[2] 24,681	[2] 24,898	[2] 34,022	[2] 34,926	[2] 34,425
Lubricants:					
Produced	31,055	32,293	31,721	34,658	34,359
Imported	37	33	8	13	39
Exported [4]	9,678	9,435	9,776	11,023	10,860
Domestic demand	20,581	22,568	21,669	23,168	23,609
Stocks at refineries at end of year	7,253	7,576	7,860	8,340	8,269
Wax (thousands of pounds):					
Produced	590,577	645,815	584,347	630,144	630,074
Stocks at refineries at end of year	116,391	185,331	167,214 [6] 150,638	110,344 [7] 112,554	189.592
Coke (thousands of short tons):					
Produced	991.0	995.3	1,145.2	1,426.6	1,820.6
Stocks at refineries at end of year	238.4	290.6	345.1	436.9	745.4
Asphalt (thousands of short tons):					
Produced	2,677.4	2,922.8	3,417.7	3,296.8	3,469.2
Stocks at refineries at end of year	159.4	193.3	220.8	235.5	240.3
Shortage [8]	22,914	26,928	28,396	29,040	35,064

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[1] Includes natural gasoline run through pipe lines in California.
[2] East of California.
[3] Includes 2,043,000 barrels in coastwise transit.
[4] Including shipments to Alaska, Hawaii, and Porto Rico.
[5] Figures not available.
[6] For comparison with 1928.
[7] For comparison with 1929.
[8] Difference between total runs to stills and the volume of the classified products reported

OIL SHALE AND SHALE OIL

The continued low price of fuel oil and other petroleum products in 1929 rendered the operation of shale-oil plants economically impossible, and the only plant which operated in the United States was the experimental plant of the Bureau of Mines at Rulison, Colo. This plant was shut down on June 30, 1927, but was reopened in May,

1928. Barring temporary shutdowns due mainly to coking shale, the plant was operated continuously through 1928 and until June 30, 1929, when it was dismantled. The Pumpherston or Scottish retort was closed down in April, 1929, but the N. T. U. or American retort was operated almost up to June 30, 1929. The results of the 1928 operations were reported in the chapter of this series for 1928. During the first six months of 1929, 501.4 short tons of shale was charged to the Pumpherston retort, from which 14,953 gallons of shale oil was recovered, an average yield of 29.8 gallons per ton. During the same period 1,446.7 short tons of shale was treated in the N. T. U. retort and 46,197 gallons of shale oil was recovered, an average of 31.9 gallons per ton.

The production of shale in Scotland in 1929 was 2,056,088 metric tons, slightly less than in 1928. This total was many times the production in the United States and several times the output in Estonia, the nation ranking second. Production in Estonia rose from 446,117 metric tons in 1928 to 517,653 metric tons in 1929, the only material gain in output of shale recorded by any nation.

World production of oil shale, 1925–1929, in metric tons

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Australia: Tasmania	833	2,161	3,201	2,637	4,368
Estonia	288,104	431,678	397,609	446,117	517,653
France[1]	67,127	69,190	(2)	(2)	(2)
Germany (Bavaria)	400	10	480	670	603
Great Britain: Scotland	2,504,390	1,991,250	2,080,122	2,070,826	2,056,088
India, British	41	----------	----------	----------	----------
Italy	2,700	3,080	4,890	1,560	1,331
Russia[3]	1,130	1,871	9,434	562	(2)
Spain	67,500	(4)	54,337	54,110	54,900
Sweden	(5)	(5)	(5)	(5)	(5)
United States	(6)	5,500	7,600	1,928	1,767

[1] Includes some boghead coal.
[2] Data not available.
[3] Year ended Sept. 30.
[4] There is in operation in Puertollano a plant for the treatment of oil shale and impure coal to obtain oil, but no details of production are available.
[5] Data on production of oil shale not available; the following quantities of shale oil were extracted from alum shale: 1925, 12 tons; 1926, 51 tons; 1927, 22 tons; 1928, none; 1929, none.
[6] Produced by one company; figures confidential and may not be disclosed.

PROPERTIES OF CRUDE OILS FROM VARIOUS FIELDS OF THE UNITED STATES

An important phase of the work of the Bureau of Mines consists in analyzing crude oils to determine their physical and chemical properties. The first publication summarizing these analyses was Report of Investigations 2202, Properties of Typical Crude Oils from the Eastern Producing Fields of the United States, by E. W. Dean, issued in January, 1921. The bureau has since published one or more analyses of the crude oil from practically every producing field of the world. The analyses of domestic crudes were summarized by the bureau in 1928 in Bulletin 291, Tabulated Analyses of Representative Crude Petroleums of the United States, by N. A. C. Smith and E. C. Lane. They were first summarized in Mineral Resources in the chapter of this series for 1925. The following data were taken from Report of Investigations 3074, Properties of California Crude Oils, by A. J. Kraemer.

Properties of crude oils from various fields of the United States

Sample No.	State	County	Field or district	Producing formation	Depth	Properties of crude					Gasoline fraction		Kerosene fraction		Viscosity at 100° F. of vacuum fractions			Carbon residue of residuum
						Specific gravity	A. P. I.	Sulphur content	Viscosity at 100° F.	Pour test	Per cent	A. P. I.	Per cent	A. P. I.	225–250° C.	250–275° C.	275–300° C.	
					Feet		°	*Per cent*		° *F.*		°		°				*Per cent*
29005	California	Kings	Kettleman Hills	Milham sand	6,990	0.739	60.0	(1)	(2)	(3)	83.7	62.3	7.8	42.1	------	------	------	--------
30251	do	Santa Barbara	Elwood	Vaqueros sand	3,403	.835	38.0	0.18	37	5	40.1	53.7	7.0	42.6	60	90	180	12.6
30255	do	Los Angeles	Playa del Rey	Gun Club sand	6,199	.906	24.7	2.60	115	15	23.6	54.9	3.6	40.2	65	115	260	12.0
27685	do	do	Inglewood	----	-------	.930	20.7	2.12	240	(3)	17.0	50.1	------	--------	80	165	420	15.0
30253	do	do	Santa Fe Springs	Hathaway	7,928	.858	33.4	.31	43	5	31.4	52.7	6.0	40.6	60	100	195	10.6

[1] Less than 0.10 per cent.

[2] Less than 32 seconds

[3] Below 5° F.

ASPHALT AND RELATED BITUMENS[1]

By A. H. Redfield[2]

SUMMARY TABLES

Supply and distribution of asphalt and related bitumens in the United States, 1926–1929, in short tons

	1926	1927	1928	1929
SUPPLY				
Native asphalt and related bitumens:				
Produced	715, 180	839, 040	807, 860	804, 027
Imported (chiefly lake asphalt)	142, 632	158, 097	119, 588	121, 019
Petroleum asphalt (excluding road oil):				
Produced at refineries from—				
Domestic petroleum	1, 031, 696	1, 304, 522	1, 392, 355	1, 657, 295
Foreign petroleum	2, 209, 401	2, 513, 017	2, 156, 172	2, 247, 460
	3, 241, 097	3, 817, 539	3, 548, 527	3, 904, 755
Stocks, Jan. 1	[1]200, 000	[1]242, 673	[1]277, 197	[1]255, 215
Total supply	[1]4, 298, 909	[1]5, 057, 349	[1]4, 753, 172	5, 085, 016
DISTRIBUTION				
Native asphalt and related bitumens:				
Indicated domestic demand	676, 962	799, 165	781, 597	757, 065
Exports (unmanufactured)	38, 218	39, 875	26, 263	46, 962
Petroleum asphalt (excluding road oil):				
Indicated domestic demand (including lake asphalt)	[1]3, 194, 467	[1]3, 556, 081	[1]3, 197, 735	3, 530, 257
Exports	146, 589	385, 031	492, 362	479, 404
Stocks, Dec. 31	[1]242, 673	[1]277, 197	[1]255, 215	271, 328
Total distribution	[1]4, 298, 909	[1]5, 057, 349	[1]4, 753, 172	5, 085, 016

[1] Revised figures.

Values of principal items of asphalt and related bitumens industry in the United States, 1926–1929

	1926	1927	1928	1929
Native asphalt and related bitumens:				
Sales	$4, 484, 960	$5, 605, 850	$5, 175, 055	$5, 470, 493
Imports (chiefly lake asphalt)	1, 045, 596	1, 140, 425	865, 046	955, 606
Exports (unmanufactured)	905, 743	1, 034, 334	683, 563	1, 133, 058
Petroleum asphalt:				
Sales (including road oil) from—				
Domestic petroleum	15, 452, 940	19, 019, 150	[a]22, 060, 312	24, 135, 787
Foreign petroleum	31, 098, 460	35, 771, 940	[a]30, 056, 866	27, 057, 868
Total sales	46, 551, 400	54, 791, 090	[a]52, 117, 178	51, 193, 655
Exports	3, 183, 746	8, 325, 413	9, 788, 501	8, 542, 975

[a] Revised figures.

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[1] Work on manuscript completed January, 1931.

[2] Figures on imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Asphalt sold by producers at mines or refineries in the United States, 1920–1929

[Value f. o. b. mine or refinery]

Year	Native asphalt and related bitumens		Manufactured asphalt (including road oil)					
			From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	198,497	$1,213,908	700,496	$11,985,457	1,045,779	$14,272,862	1,746,275	$26,258,319
1921	296,412	1,985,583	624,220	9,048,221	908,093	11,761,358	1,532,313	20,809,579
1922	327,792	2,253,180	805,145	10,385,925	1,242,163	13,899,407	2,047,308	24,285,332
1923	400,236	2,885,631	995,654	13,060,174	1,378,722	16,840,045	2,374,376	29,900,219
1924	562,367	3,958,339	1,158,456	14,305,007	1,920,915	21,710,793	3,079,371	36,015,800
1925	584,850	4,148,400	1,206,700	15,305,760	1,971,670	27,520,010	3,178,370	42,825,770
1926	715,180	4,484,960	1,245,160	15,452,940	2,213,310	31,098,460	3,458,470	46,551,400
1927	839,040	5,605,850	1,525,420	19,019,150	2,426,030	35,771,940	3,951,450	54,791,090
1928	807,860	5,175,055	[1] 1,930,536	[1] 22,060,312	[1] 2,298,848	[1] 30,056,866	[1] 4,229,384	[1] 52,117,178
1929	804,027	5,470,493	2,332,973	24,135,787	2,355,498	27,057,868	4,688,471	51,193,655

[1] Revised figures.

NATIVE ASPHALTS AND BITUMENS

BITUMINOUS ROCK

SALES

Sales of native rock asphalt by producers in the United States decreased 1.6 per cent in quantity (from 760,497 short tons in 1928 to 748,550 tons in 1929) but increased 0.3 per cent in value (from $4,060,276 in 1928 to $4,071,173 in 1929). The average value realized per ton sold increased from $5.34 in 1928 to $5.44 in 1929. Eighty-eight per cent of the total tonnage of rock asphalt sold in 1929 was mined in two States—Kentucky and Texas; minor amounts were produced in Alabama, California, Oklahoma, and Utah.

Although programs of road improvement were curtailed in many places and there was much bad weather during the construction season, sales of rock asphalt by producers in Kentucky increased 6.8 per cent in quantity (from 318,548 short tons in 1928 to 340,346 tons in 1929) and 1 per cent in value (from $2,757,547 in 1928 to $2,785,772 in 1929). Prices in Kentucky were lower; the average sales value per ton dropped 5.4 per cent (from $8.66 in 1928 to $8.19 in 1929). The number of producers decreased from five in 1928 to four in 1929. The producers in 1929 were the Kentucky Rock Asphalt Co., operating at Kyrock, Edmonson County; the Natural Rock Asphalt Corporation, operating at Natural Rock, Edmonson County; the Ohio Valley Rock Asphalt Co., operating in Grayson County, near Leitchfield, and in Hardin County, near Elizabethtown; and the United Rock Asphalt Co., operating at Asphalt, Edmonson County.

Shipments of limestone rock asphalt from Uvalde and Kinney Counties, Tex., decreased 0.2 per cent in quantity (from 321,505 short tons in 1928 to 320,931 tons in 1929) but increased 16 per cent in value (from $815,482 in 1928 to $946,003 in 1929). The average sales value per ton increased 16.1 per cent (from $2.54 in 1928 to $2.95 in 1929). Three companies were active in both 1928 and 1929: The Texas Rock Asphalt Co., operating near Uvalde; the Uvalde Rock Asphalt Co., operating near Blewett; and White's Uvalde Mines, operating 10 miles south of Cline.

Native asphalt and related bitumens sold at mines in the United States, 1925–1929, by varieties and by States

[Value f. o. b. mine]

	1925		1926		1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Bituminous rock:										
Alabama	23, 550	$77, 080	22, 000	$101, 000	32. 650	$128, 700	110, 360	$406, 575	77. 209	$258, 886
Oklahoma	27, 450	82, 830	37, 010	121, 830	42, 460	132, 380				
California	2, 680	16, 100	3, 330	19. 310						
Kentucky	286, 850	2, 493, 360	320, 430	2. 530, 480	344. 220	3, 156, 700	318, 548	2, 757, 547	340, 346	2, 785, 772
Texas	204 530	692, 730	289, 980	825, 610	376. 770	1, 254, 500	321, 505	815, 482	320, 931	946, 003
Utah	------	---------	-------	---------	-------	---------	10, 084	80, 672	10, 064	80, 512
Total bituminous rock	545, 060	3, 362, 100	672, 750	3, 598, 230	796, 100	4, 672, 280	760, 497	4, 060, 276	748, 550	4, 071, 173
Gilsonite: Utah	39, 520	767, 900	42, 190	863, 840	42, 580	876, 820	47, 023	1, 037, 679	54, 987	1, 235, 920
Ozokerite: Utah	------	---------	-------	---------	80	32, 000	150	60, 000	290	133, 400
Wurtzilite: Utah	270	18, 400	240	22, 890	280	24, 750	190	17, 100	200	30, 000
Grand total	584, 850	4, 148, 400	715, 180	4, 484, 960	839. 040	5, 605, 850	807, 860	5, 175, 055	804, 027	5, 470, 493
RÉSUMÉ BY STATES										
Alabama	23, 550	77, 080	22, 000	101, 000	32, 650	128, 700	110, 360	406, 575	77, 209	258, 886
Oklahoma	27, 450	82, 830	37, 010	121, 830	42, 460	132, 380				
California	2, 680	16, 100	3, 330	19, 310						
Kentucky	286, 850	2, 493. 360	320, 430	2, 530, 480	344, 220	3, 156, 700	318, 548	2, 757, 547	340, 346	2, 785, 772
Texas	204, 530	692, 730	289, 980	825, 610	376, 770	1, 254, 500	321, 505	815, 482	320, 931	946, 003
Utah	39, 790	786, 300	42, 430	886, 730	42, 940	933, 570	57, 447	1, 195, 451	65, 541	1, 479, 832
Grand total	584, 850	4, 148, 400	715, 180	4, 484, 960	839, 040	5, 605, 850	807, 860	5, 175, 055	804, 027	5, 470, 493

DOMESTIC DEMAND

The indicated domestic demand for natural rock asphalt, calculated by subtracting the known exports from the total sales, decreased from the maximum of 756,225 short tons in 1927 to 734,234 tons in 1928 and 701,588 tons in 1929.

Practically all the natural rock asphalt produced is used for street and highway surfacing. Complete statistics of the mileage of rural highways surfaced with natural rock asphalt are not available. In the statistics of State, county, and local highway construction published by the Bureau of Public Roads, Department of Agriculture, most of the natural rock asphalt is included in the mileage of sheet asphalt built.

A survey of street paving in 201 representative American cities, conducted by the Bureau of Mines[3], shows that 852,725 square yards of natural rock asphalt was laid in 1925; 814.444 square yards in 1926; 1,163,335 square yards in 1927; 1,099,940 square yards in 1928; and 1,086,780 square yards in 1929. Nearly 83 per cent of the total area surfaced with natural rock asphalt from January 1, 1925, to December 31, 1929, was laid in the Southwestern district, chiefly in Texas, Louisiana, Oklahoma, and Kansas. Only 9.2 per cent was laid in the Southeastern district, chiefly in Alabama, Tennessee, and West Virginia, and only 8.3 per cent in the Northeastern district, chiefly in Illinois and Ohio.

More than 57 per cent of the total rock-asphalt pavement laid was in cities with populations ranging from 250,000 to 500,000, 13.5 per cent in cities of 100,000 to 250,000 inhabitants, and 27.7 per cent in cities of 40,000 to 100,000.

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[3] Redfield, A. H., Street Paving in Representative American Cities, 1925–1929: Bur. Mines Inf. Circ. 6431, 1931, 30 pp.

Natural rock asphalt street pavement laid in 201 representative American cities, 1925–1929, by districts, in square yards

District	1925	1926	1927	1928	1929
Northeastern	88,209	129,109	78,756	111,617	9,564
Southeastern	67,922	39,926	75,885	103,344	172,096
Southwestern	696,594	645,409	1,008,694	884,979	905,120
	852,725	814,444	1,163,335	1,099,940	1,086,780

EXPORTS

A rise of nearly 14,000 short tons in exports of rock asphalt to Italy and greater exports to northern and western Europe resulted in an increase of 78.8 per cent in quantity and 65.8 per cent in value of total exports of natural rock asphalt (unmanufactured) in 1929. From 26,263 short tons, valued at $683,563, in 1928 exports rose to 46,962 tons, valued at $1,133,058, in 1929. Seventy-five per cent of the total in 1929 went to Europe, chiefly to Italy, the United Kingdom, Germany, the Irish Free State, and France; 11.3 per cent went to Canada; 5.4 per cent to Brazil; and 2.8 per cent to Australia.

GILSONITE

Sales of gilsonite by producers in Uintah County, Utah, increased 16.9 per cent in quantity (from 47,023 short tons in 1928 to 54,987 tons in 1929) and apparently 19.1 per cent in value (from $1,037,679 in 1928 to $1,235,920 in 1929). However, this apparent increase in value is due to the practice of one company in reporting its sales value largely on the basis of delivered prices at the consumers' plants many hundred miles distant from the mine. Actually, prices at the mines in 1929 ranged from $14.50 to $28 per ton; the average was 2 per cent higher than in 1928.

The following five producers were active in Uintah County in both 1929 and 1928: The American Asphalt Association, operating near Dragon; the Diamond Gilsonite Co., operating near Fort Duchesne; the Gilson Asphaltum Co., operating near Watson; the Raven Mining Co. of Utah, operating near Roosevelt; and the Utah Gilsonite Co., operating near Watson.

The occurrence, physical and chemical properties, mining, grading, shipping, and uses of gilsonite, as well as those of glance pitch, grahamite, and manjak, are discussed by Langton.[4]

OZOKERITE

Sales of ozokerite by the producer in Utah nearly doubled in quantity (from 150 short tons in 1928 to 290 tons in 1929) and more than doubled in value (from $60,000 in 1928 to $133,400 in 1929).

Fully 97 per cent of the mineral wax consumed in the United States since 1922 has been obtained from foreign countries. Imports of mineral wax for consumption in the United States decreased 10.2 per cent in quantity (from 5,451 short tons in 1928 to 4,896 tons in 1929) but increased 3.7 per cent in value (from $594,416 in 1928 to $616,617 in 1929). These imports included not only ozokerite, crude and refined, but also montan wax derived from the distillation of lignite and imported chiefly from Germany.

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[4] Langton, H. M., Gilsonite and Related Bitumens: Ind. Chem. and Chem. Eng., vol. 5, 1929, pp. 324–326 and 383–386

Experiments by F. Kirchhof[5] tended to show that a mixture of ozokerite with 3 to 5 per cent of wurtzilite blended with rubber tends to hinder oxidation and retard the aging of the finished product.

Ozokerite and other mineral waxes imported for consumption in the United States, 1920–1929

Year	Pounds	Value	Year	Pounds	Value
1920	4,272,341	$499,758	1925	6,175,184	$361,767
1921	8,548,542	546,054	1926	8,287,397	479,957
1922	8,989,972	371,161	1927	7,599,708	579,118
1923	4,856,357	213,407	1928	10,901,389	594,416
1924	3,113,819	207,833	1929	9,791,090	616,617

WURTZILITE (ELATERITE)

Sales of wurtzilite (elaterite) by the producer in Duchesne County, Utah, increased from 190 short tons, valued at $17,100, in 1928 to 200 tons, valued at $30,000, in 1929.

ICHTHYOL

Imports of ichthyol and ichthyol substitutes decreased 23.7 per cent in quantity (from 42,610 pounds in 1928 to 32,529 pounds in 1929) and 30.3 per cent in value (from $60,321 in 1928 to $42,066 in 1929). Most of the 1929 imports came from Germany; minor imports came from France.

PRODUCERS

Production of native asphalts and related bitumens was reported in this country in 1929 by the following operators:

Alabama Rock Asphalt (Inc.), 310 Pioneer Building, Birmingham, Ala.
American Asphalt Association, 919 Wainwright Building, St. Louis, Mo.
Bitumen Mines Operation, 839 Post Street, San Francisco, Calif.
Diamond Gilsonite Co., Fort Duchesne, Utah.
Gilson Asphaltum Co., 1600 Arch Street, Philadelphia, Pa.
Kentucky Rock Asphalt Co., 711–718 Marion E. Taylor Building, Louisville, Ky.
National Bitumen Products Corporation, 1019 Monadnock Building, San Francisco, Calif.
Natural Rock Asphalt Corporation, Natural Rock, Ky.
Ohio Valley Rock Asphalt Co., Starks Building, Louisville, Ky.
Ozokerite Mining Co. (Inc.), Soldier Summit, Utah.
Raven Mining Co. of Utah, 140 South Dearborn Street, Chicago, Ill.
D. A. Sattler, Box 85, Carpinteria, Calif.
Texas Rock Asphalt Co., 1002 Frost Bank Building, San Antonio, Tex.
United Rock Asphalt Co., 1610 Intersouthern Building, Louisville, Ky.
Utah Gilsonite Co., 622 Wainwright Building, St. Louis, Mo.
Utah Rock Asphalt Corporation, 441 Thatcher Building, Pueblo, Colo.
Uvalde Rock Asphalt Co., P. O. Box 958, San Antonio, Tex.
Western Paving Co., 1519 Petroleum Building, Oklahoma City, Okla.
White's Uvalde Mines, P. O. Box 902, San Antonio, Tex.

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[5] Kirchhof, F., Étude de l'Action des Mélanges d'Ozokérite Brute et d'Agérite sur le Vieillissement des Mélanges de Caoutchouc: Caoutchouc et Gutta-Percha, vol. 26, 1929, pp. 14501–14503.

MANUFACTURED OR PETROLEUM ASPHALT

GENERAL STATEMENT

Improved domestic demand in 1929 was met by larger refinery production of asphalt in 1929 than in 1928 and even than in 1927. The tonnage of petroleum asphalt sold at refineries was larger; but prices were lower, and the total value realized was slightly less in 1929 than in 1928. Stocks of petroleum asphalt held at refineries increased in quantity during the year, but the ratio of the stocks held on December 31, 1929, to the indicated domestic demand in 1929 was lower than the ratio of the stocks held on December 31, 1928, to the indicated domestic demand in 1928. Imports, chiefly lake asphalt, were only slightly larger in 1929 than in 1928. Exports were slightly less than in 1928, and their ratio to total sales of asphalt from both domestic and foreign petroleum was decreased somewhat also.

REFINERY PRODUCTION

The refinery production of petroleum asphalt (exclusive of road oil) in 1929 exceeded that of 1928 by 10 per cent and that of 1927, the year of previous maximum production, by 2.3 per cent. From 3,817,539 short tons in 1927 and 3,548,527 tons in 1928 production increased to 3,904,755 tons in 1929. The principal gains took place in the East coast district, which produced 1,691,653 tons in 1928 and 1,770,906 tons in 1929; in the Indiana-Illinois district, which produced 418,681 tons in 1928 and 688,842 tons in 1929; and in the California district, which produced 620,080 tons in 1928 and 659,226 tons in 1929. The output of refineries in the Gulf coast district of Texas increased from 207,700 tons in 1928 to 216,336 tons in 1929, whereas the output of the refineries of coastal Louisiana, near New Orleans and Baton Rouge, decreased from 562,300 tons in 1928 to 459,149 tons in 1929. The tonnages of asphalt produced in northern Louisiana and Arkansas, in the Appalachian district, and in the Oklahoma-Kansas district were proportionately much larger in 1929 than in 1928.

Asphalt (exclusive of road oil) produced at refineries in the United States, 1926–1929, by districts, in short tons[1]

District	1926	1927	1928	1929
East coast	1,520.322	1,846,282	1,691,653	1,770,906
Appalachian	5,114	6,471	7,981	26,743
Indiana-Illinois	264,418	402,321	418,681	688,842
Oklahoma-Kansas-Missouri	16,025	5,370	9,665	27,793
Texas:				
Gulf coast	275,859	373,933	207,700	216,336
Rest of State	2		728	580
Total Texas	275,861	373,933	208,428	216,916

[1] These figures for 1926 and 1927, compiled directly from returns made by petroleum refineries producing asphalt, differ from the statistics of asphalt production published on page 74 of the Asphalt chapter of Mineral Resources of the United States in 1927, and on pages 40 and 41 of Petroleum Refinery Statistics, 1927 (Bureau of Mines Bulletin 297) chiefly because of the differences in classification. In the monthly and annual refinery statements some of the more liquid products are listed under "All other finished products."

Asphalt (exclusive of road oil) produced at refineries in the United States, 1926–1929, by districts, in short tons—Continued

District	1926	1927	1928	1929
Louisiana-Arkansas:				
Louisiana Gulf coast	605,418	602,066	562,300	459,149
Northern Louisiana and Arkansas	21,551	19,566	15,443	45,670
Total Louisiana and Arkansas	626,969	621,632	577,743	504,819
Rocky Mountain	37,021	26,221	14,296	9,510
California	495,367	535,309	620,080	659,226
Grand total	3,241,097	3,817,539	3,548,527	3,904,755

SOURCE OF RAW MATERIAL

The ratio of asphalt from foreign crude to total production decreased from 60.8 per cent in 1928 to 57.6 per cent in 1929. Although 2.7 per cent less foreign crude, imported chiefly from Venezuela, Mexico, and Colombia, was run to stills in 1929 than in 1928, the production of asphalt from foreign crude increased 4.2 per cent (from 2,156,172 short tons in 1928 to 2,247,460 tons in 1929). Of the 2,247,460 tons of asphalt made from foreign crude oil in 1929, 1,746,772 tons was manufactured in refineries of the Atlantic seaboard and 500,688 tons in refineries of coastal Louisiana and Texas. In the East coast district, 93 per cent of the total asphalt produced in 1928 and 98.6 per cent of that in 1929 was made from foreign crude oil, although only 40.5 per cent of the crude run to stills on the Atlantic seaboard in 1928 and only 40 per cent of that in 1929 was of foreign origin. In the Gulf coast district 76 per cent of the total asphalt produced in 1928 and 74.1 per cent of that in 1929 was made from foreign raw material, although foreign crude formed only 4.6 per cent of the total crude oil run to stills on the Gulf coast in 1928 and 4.5 per cent in 1929.

Foreign crude petroleum run to stills at refineries in the United States, 1928 and 1929, in thousands of barrels

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1928													
East coast	4,648	4,764	5,284	5,355	5,937	6,686	6,572	5,901	6,078	5,940	5,757	5,864	68,786
Texas Gulf coast	53	67	56	70	117	70	94	97	87	297	129	109	1,246
Louisiana Gulf coast	321	457	392	414	560	490	503	992	944	1,161	670	648	7,552
	5,022	5,288	5,732	5,839	6,614	7,246	7,169	6,990	7,109	7,398	6,556	6,621	77,584
1929													
East coast	5,687	5,319	5,630	5,424	6,039	6,294	5,856	5,588	5,495	5,233	5,171	4,511	66,247
Texas Gulf coast	100	37	118	403	473	469	219	338	112	138	167	299	2,873
Louisiana Gulf coast	639	723	866	833	692	528	338	364	384	297	360	373	6,397
	6,426	6,079	6,614	6,660	7,204	7,291	6,413	6,290	5,991	5,668	5,698	5,183	75,517

Although the quantity of domestic petroleum run to stills was only 9.2 per cent larger in 1929 than in 1928, the production of asphalt from domestic petroleum increased 19 per cent (from 1,392,355 tons in 1928 to 1,657,295 tons in 1929). Asphalt of purely domestic origin constituted 39.2 per cent of the total asphalt produced in 1928 and

42.4 per cent in 1929. Of the 1,657,295 tons of asphalt made from domestic crude in 1929, 41.6 per cent was made in the Indiana-Illinois district, chiefly from Mid-Continent crude, 39.8 per cent in California from California crude, and 9.9 per cent in refineries of the Texas Gulf coast, principally from Mid-Continent and Gulf coast crude.

SEASONAL VARIATION IN MANUFACTURE

In 1929, as in the previous five years, about 60 per cent of the total output of asphalt was produced in the six months from May 1 to October 31, and about 30 per cent was produced in the third quarter of the year. The highest output for any single month in 1929 was that in July. A higher percentage of the annual total was produced in the third quarter of 1929 and a lower percentage in the fourth quarter of 1929 than the average of percentages for the previous five years.

These percentages are based on production data published monthly and annually by the Bureau of Mines in its Petroleum Refinery Statistics. Owing to differences in the classification of asphaltic products, they cover only about 89 per cent of the total production of asphalt (exclusive of road oil) recorded on pages 528 and 529; nevertheless, they are believed to indicate with reasonable accuracy the trend of monthly production.

Per cent of asphalt produced in petroleum refineries in the United States, 1925–1929, by months

Month	1925	1926	1927	1928	1929	5-year average
January	6.0	5.6	5.6	6.1	5.4	5.7
February	4.4	5.2	5.1	6.3	6.0	5.4
March	6.5	7.2	6.5	8.0	6.6	7.0
April	7.8	6.8	8.0	8.3	8.2	7.8
May	9.9	8.5	9.3	10.0	9.1	9.4
June	9.9	10.3	10.1	10.0	9.4	9.9
July	10.2	9.6	9.8	10.0	11.1	10.1
August	10.8	10.5	9.9	9.6	10.9	10.4
September	9.9	10.5	9.8	9.3	10.5	10.0
October	10.6	11.1	9.7	9.7	10.3	10.3
November	8.2	7.4	8.5	7.4	7.1	7.7
December	5.8	7.3	7.7	5.3	5.4	6.3
	100.0	100.0	100.0	100.0	100.0	100.0

The production of asphalt at refineries during the first three months of 1929 decreased 7.4 per cent compared with the output in the first three months of 1928 but increased 6.5 per cent compared with that in the corresponding quarter of 1927, according to monthly statements on refined products made from petroleum published by the Bureau of Mines. During the second quarter of 1929, however, production fell 1.2 per cent below the output for the second quarter of 1928 and 1.5 per cent below that of 1927. To the end of June, 1929, production had decreased 4 per cent compared with that of the first half of 1928 but had increased 1.5 per cent over that of the first half of 1927. The principal gains in 1929 were made in the third quarter of the year when 18.6 per cent more asphalt was produced than in the third quarter of 1928 and 12.2 per cent more than in the corresponding quarter of 1927. In the last three months of 1929 7.8 per cent more petroleum asphalt was produced than in the last quarter of 1928, but 10.6 per cent less than in the corresponding quarter of 1927.

REFINERY STOCKS

Stocks of petroleum asphalt held at refineries increased 6.3 per cent during 1929 (from 255,215 short tons on December 31, 1928, to 271,328 tons on December 31, 1929). In terms of the indicated domestic demand they amounted to 29 days' supply on December 31, 1928, and to 27.7 days' supply on December 31, 1929. The chief increase in storage was in the East coast district, where stocks rose 16.1 per cent during the year, and in the Indiana-Illinois district, where they rose 16.7 per cent. On the other hand, stocks held in California decreased 21.2 per cent during the year and stocks held in coastal Louisiana decreased 9.4 per cent.

Refinery stocks were maintained at a remarkable level over the entire country; less proportionate change took place from month to month during 1929 than during any recent year. Stocks as reported in the monthly refinery statistics of the Bureau of Mines ranged from 250,100 short tons or 25.8 days' supply on March 31, 1929, to 227,400 tons or 23.4 days' supply on October 31. They averaged 239,100 tons during 1929, compared with an average of 239,000 tons for 1928. Owing to differences in reporting asphalt production and stocks in the monthly and in the annual statements submitted by refiners to the Bureau of Mines, the monthly figures comprise only about 89 per cent of the national stocks of all asphalts, other than road oils; nevertheless they may be taken as illustrative of the general trend of asphalt stocks.

Production, stocks, and sales of petroleum asphalt (exclusive of road oil) at refineries in the United States in 1929, by districts, in short tons

District	Production	Stocks		Sales
		Dec. 31, 1928 [1]	Dec. 31, 1929	
East coast	1,770,906	79,836	92,721	1,758,021
Appalachian	26,743	1,075	3,666	24,152
Indiana-Illinois	688,842	64,976	75,805	[2] 678,013
Oklahoma-Kansas-Missouri	27,793	1,484	3,436	25,841
Texas:				
Gulf coast	216,336	13,293	13,903	215,726
Rest of State	580	49	42	587
Total Texas	216,916	13,342	13,945	216,313
Louisiana and Arkansas:				
Louisiana Gulf coast	459,149	44,687	40,508	463,328
Northern Louisiana and Arkansas	45,670	2,606	4,525	43,751
Total Louisiana and Arkansas	504,819	47,293	45,033	507,079
Rocky Mountain	9,510	4,365	2,973	10,902
California	659,226	42,844	33,749	668,321
Grand total	3,904,755	255,215	271,328	3,888,642

[1] Revised figures.
[2] Includes 53,233 tons of asphalt consumed by the producing companies

SALES BY USES

Refinery sales of petroleum asphalt (exclusive of road oil) in the United States and in foreign countries amounted to 3,888,642 tons in 1929. This is an increase of 8.9 per cent over the 3,572,274 tons sold in 1928 and of 6.4 per cent over the 3,654,340 tons sold in 1927. Although the tonnage of asphalt sold in 1929 was larger than in 1928 or 1927 the total values realized from sales were lower than in either year. The $43,889,434 obtained from asphalt sales in 1929 was 5.1 per cent less than the $46,268,546 obtained in 1928 and 15 per cent less than the $51,661,570 obtained in 1927.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries in the United States, 1928 and 1929, by varieties

	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1928						
Solid and semisolid products of less than 200 penetration: [1]						
Asphalt for—						
Paving	636, 533	$8, 867, 658	912, 821	$12, 403, 651	1, 549, 354	$21, 271, 309
Roofing	[2] 437, 453	[2] 5, 153, 640	[2] 708, 033	[2] 8, 799, 086	[2] 1, 145, 486	[2] 13, 952, 726
Waterproofing	[2] 48, 149	[2] 600, 312	[2] 88, 307	[2] 1, 263, 657	[2] 136, 456	[2] 1, 863, 969
Blending with rubber	3, 812	72, 897	17, 862	233, 529	21, 674	306, 426
Miscellaneous uses	75, 864	864, 050	98, 887	1, 258, 628	174, 751	2, 122, 678
	1, 201, 811	15, 558, 557	1, 825, 910	23, 958, 551	3, 027, 721	39, 517, 108
Semisolid and liquid products of more than 200 penetration: [1]						
Flux for—						
Paving	28, 320	404, 535	98, 857	1, 740, 128	127, 177	2, 144, 663
Roofing	94, 609	1, 079, 293	172, 082	1, 937, 792	266, 691	3, 017, 085
Waterproofing	245	10, 236	----------	------------	245	10, 236
Other liquid products	72, 551	582, 362	77, 889	997, 092	150, 440	1, 579, 454
	195, 725	2, 076, 426	348, 828	4, 675, 012	544, 553	6, 751, 438
Grand total	1, 397, 536	17, 634, 983	2, 174, 738	28, 633, 563	3, 572, 274	46, 268, 546
1929						
Solid and semisolid products of less than 200 penetration: [1]						
Asphalt for—						
Paving	547, 176	7, 194, 382	979, 223	11, 806, 133	1, 526, 399	19, 000, 515
Roofing	601, 155	6, 461, 699	451, 507	5, 128, 156	1, 052, 662	11, 589. 855
Waterproofing	43, 192	629, 209	62, 249	742, 508	105, 441	1, 371, 717
Blending with rubber	2, 481	67, 168	22, 843	250, 703	25, 324	317, 871
Briquetting	53, 367	551, 483	11, 768	145, 224	65. 135	696, 707
Mastic and mastic cake	1, 364	23, 686	425	6, 395	1, 789	30, 081
Pipe coatings	7, 868	125, 282	4. 914	74, 586	12, 782	199, 868
Molding compounds	40	1, 004	2, 239	23, 991	2, 279	24, 995
Miscellaneous uses	128, 540	854, 651	80, 565	350, 073	209, 105	1, 204, 724
	1, 385, 183	15, 908, 564	1, 615, 733	18, 527, 769	3, 000, 916	34, 436, 333

See footnotes at end of table.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries in the United States, 1928 and 1929, by varieties—Continued

	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1929						
Semisolid and liquid products of more than 200 penetration:[1]						
Flux for—						
Paving	54, 332	$563, 298	130, 924	$2, 187, 394	185, 256	$2, 750, 692
Roofing	86, 552	797, 807	328, 431	2, 994, 305	414, 983	3, 792, 112
Waterproofing	22, 515	225, 776			22, 515	225, 776
Mastic			82	678	82	678
Cut-back asphalts	21, 801	314, 842	107, 894	1, 359, 404	129, 695	1, 674, 246
Emulsified asphalts and fluxes	148	5, 320	14, 662	175, 944	14, 810	181, 264
Paints, enamels, japans, and lacquers			210	6, 653	210	6, 653
Other liquid products	79, 856	412, 188	40, 319	409, 492	120, 175	821, 680
	265, 204	2, 319, 231	622, 522	7, 133, 870	887, 726	9, 453, **101**
Grand total	1, 650, 387	18, 227, 795	2, 238, 255	25, 661, 639	3, 888, 642	43, 889, **484**

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[1] Definitions:

Paving asphalt.—Refined asphalt and asphaltic cement, fluxed and unfluxed, produced for direct use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and asphalt block pavements, and also for use as joint filler in brick, block, and monolithic pavements.

Roofing asphalt.—Asphalt and asphaltic cement used in saturating, coating, and cementing felt or other fabric and in the manufacture of asphalt shingles.

Waterproofing asphalt.—Asphalt and asphaltic cement used to waterproof and dampproof tunnels, foundations of buildings, retaining walls, bridges, culverts, etc., and for constructing built-up roofs.

Briquetting asphalt.—Asphalt and asphaltic cement used to bind coal dust or coke breeze into briquets.

Mastic and mastic cake.—Asphalt and asphaltic cement for laying foot pavements and floors, waterproofing railway bridges, lining reservoirs and tanks, capable of being poured and smoothed by hand-troweling.

Pipe coatings.—Asphalt and asphaltic cement used to protect metal pipes from corrosion.

Molding compounds.—Asphalts used in the preparation of molding compositions, such as battery boxes, electrical fittings, push buttons, knobs, handles, and other equipment.

Miscellaneous uses.—Asphalts and asphaltic cement used as dips and in the manufacture of acid-resisting compounds, putty, saturated building paper, fiber-board, and floor coverings, and not included in the preceding definitions.

Flux.—Liquid asphaltic material used in softening native asphalt or solid asphalt for paving, roofing, waterproofing, and other purposes.

Cut-back asphalts.—Asphalts softened or liquified by mixing them with petroleum distillates.

Emulsified asphalts and fluxes.—Asphalts and fluxes emulsified with water for cold-patching, road laying, and other purposes.

Other liquid products.—Petroleum asphalt, exclusive of fuel oil used for heating purposes, not included in the preceding definitions.

[2] Revised figures.

The average sales value per short ton of asphaltic products other than road oil decreased 12.8 per cent (from $12.95 in 1928 to $11.29 in 1929). The principal decreases took place in paving asphalt, which sold at an average of $13.73 a ton in 1928 and $12.45 in 1929; in roofing asphalt, which sold at $12.18 a ton in 1928 and $11.01 in 1929; in paving flux, which sold at $16.86 a ton in 1928 and $14.85 in 1929; and in roofing flux, which sold at $11.31 a ton in 1928 and $9.14 in 1929.

As in previous years, the major sources of sales revenue for petroleum asphalt were paving and roofing. Solid and semisolid asphalt for paving contributed 46.0 per cent of the total value of asphalt sold in 1928 and 43.3 per cent in 1929. Sales of paving flux amounted to 4.6 per cent of the total value in 1928 and 6.3 per cent of the total in 1929. Roofing asphalt, which accounted for 30.2 per cent of the total value of sales in 1928, furnished 26.4 per cent of the total value in 1929. Roofing flux yielded 6.5 per cent of the total sales value in 1928 and 8.6 per cent in 1929. In addition, sales of waterproofing asphalt comprised 4.0 per cent of the total value in 1928 and 3.1 per cent in 1929.

PAVING

As in 1928, four refining districts furnished together nearly 99 per cent of all paving asphalt sold in 1929. Refineries of the East coast district supplied 54.1 per cent of the paving asphalt sold in 1928 and 54.8 per cent in 1929. Gulf coast asphalt plants furnished 17.7 per cent of the paving asphalt in 1928 and 17.4 per cent in 1929. California refineries sold 23.6 per cent of the paving asphalt in 1928 and 23.0 per cent in 1929. Only 3.7 per cent of the paving asphalt sold in 1928 and only 3.2 per cent in 1929 came from refineries of the Indiana-Illinois district.

Decreased use of bituminous compounds in rural highway building and in city-street paving was reflected in a decline of 1.5 per cent in sales of asphalt for paving and road building (from 1,549,354 short tons in 1928 to 1,526,399 tons in 1929). The value of paving asphalt sold decreased 10.7 per cent (from $21,271,309 in 1928 to $19,000,515 in 1929). Paving asphalt constituted 43.4 per cent of the total tonnage of asphalt sold in 1928 but only 39.3 per cent in 1929.

The total mileage of bituminous-surfaced highways built in the United States decreased 11.7 per cent (from 4,558 miles in 1928 to 4,023 miles in 1929), according to statistics compiled and published by the Bureau of Public Roads, but as the total mileage of hard-surfaced roads in the United States increased 3.6 per cent from 1928 to 1929 the relative position of asphaltic roads in the total hard-surfaced mileage decreased from 38.3 per cent in 1928 to 32.6 per cent in 1929. At the same time, the street area paved with bituminous compounds in 201 representative cities of the United States decreased 4.6 per cent (from 33,193,626 square yards in 1928 to 31,677,936 square yards in 1929), according to a survey made by the Bureau of Mines and published as Information Circular 6431. This decrease, however, coincided with a general decrease of 8.7 per cent in all types of paving, so that the ratio of bituminous paving to the total street paving laid increased from 62.1 per cent in 1928 to 64.8 per cent in 1929.

Hard-surfaced rural highways built and reconstructed in the United States, 1925–1929, by types of paving, in miles [1]

Type	1925	1926	1927	1928	1929
Sheet asphalt	199	368	224	308	170
Bituminous concrete	777	766	621	640	616
Bituminous macadam	2,249	2,701	2,581	3,610	3,237
Asphalt block	25		22		
Total bituminous	3,250	3,835	3,448	4,558	4,023
Other pavement	6,050	5,772	6,519	7,337	8,302
Total pavement	9,300	9,607	9,967	11,895	12,325

[1] Source: Bureau of Public Roads, Department of Agriculture.

Total area of street pavement laid in 201 representative American cities, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	18, 776, 011	19, 489, 373	21, 404, 872	19, 135, 125	17, 932, 095
Asphaltic concrete	9, 845, 142	12, 188, 700	9, 759, 280	9, 729, 686	8, 228, 577
Asphaltic macadam	1, 346, 935	1, 502, 708	1, 369, 836	1, 719, 319	2, 586, 820
Asphalt block	416, 523	961, 495	991, 092	203, 987	133, 788
Natural rock asphalt	852, 725	814, 444	1, 163, 335	1, 099, 940	1, 086, 780
Other asphaltic types	1, 800, 582	1, 519, 812	1, 615, 689	1, 295, 470	1, 699, 876
Tar macadam	114, 433	39, 055	27, 917	10, 099	10, 000
Total bituminous	33, 152, 351	36, 515, 587	36, 332, 021	33, 193, 626	31, 677, 936
Other pavement	14, 134, 234	17, 023, 173	21, 612, 230	20, 301, 299	17, 190, 100
Total pavement	47, 286, 585	53, 538, 760	57, 944, 251	53, 494, 925	48, 868, 036

Similarly, on Federal-aid highways bituminous macadam and bituminous concrete together amounted to 1,253 miles or 30.1 per cent of the total hard-surfaced mileage initially constructed during the fiscal year ended June 30, 1925, but comprised only 733 miles or 22.4 per cent of the hard-surfaced mileage constructed in the fiscal year 1926, only 623 miles or 23.4 per cent of the hard-surfaced mileage completed in 1927, only 600 miles or 18.9 per cent of the hard-surfaced mileage completed in 1928, and only 513 miles or 18.0 per cent of the hard-surfaced mileage completed in the fiscal year 1929. The increase to 614 miles or 20.5 per cent of the total hard-surfaced mileage in the fiscal year ended June 30, 1930, was due to the laying in that year of 160 miles of low-cost bituminous mixtures not previously employed on Federal-aid projects.

Mileage of Federal-aid hard-surfaced roads initially completed in fiscal year ended June 30, 1926–1930, by types [1]

Type	1926	1927	1928	1929	1930
Bituminous macadam	553	463	464	381	319
Bituminous concrete	180	160	136	132	135
Low-cost bituminous types					160
Total bituminous	733	623	600	513	614
Other hard-surfaced types	2, 542	2, 042	2, 575	2, 328	2, 380
Total hard-surfaced	3, 275	2, 665	3, 175	2, 841	2, 994

[1] Source: Bureau of Public Roads, Department of Agriculture.

Although the sales of solid and semisolid asphalt for paving decreased slightly from 1928 to 1929, sales of paving flux increased 45.7 per cent in quantity (from 127,177 short tons in 1928 to 185,256 tons in 1929) and 28.3 per cent in value (from $2,144,663 in 1928 to $2,750,692 in 1929). The principal gains took place in California, where no paving flux was sold in 1928 but 32,721 tons was sold in 1929; in the Gulf coast district, where 12,790 tons was sold in 1928 and 42,236 tons in 1929; and in the Indiana-Illinois district, where 9,013 tons was sold in 1928 and 14,491 tons in 1929.

ROOFING

Although more prepared roofing was shipped from factories in 1929 than in 1928 refinery sales of roofing asphalt decreased 8.1 per cent in tonnage (from 1,145,486 short tons in 1928 to 1,052,662 tons in

1929). On the other hand, factory shipments of prepared roofing increased 9.1 per cent (from 36,539,724 squares in 1928 to 39,868,811 squares in 1929), according to statistics published in the Survey of Current Business. Railroad shipments of building paper and prepared roofing materials increased 14.3 per cent (from 2,034,812 short tons in 1928 to 2,324,998 tons in 1929), according to the freight commodity statistics published by the Interstate Commerce Commission.

The principal decreases in roofing asphalt sold occurred in the seaboard refineries of the Atlantic and Gulf coasts. In the East coast district, sales of roofing asphalt decreased 34.2 per cent (from 424,918 short tons in 1928 to 279,769 tons in 1929), and in the Gulf coast district sales of roofing asphalt decreased 39.6 per cent (from 329,700 short tons in 1928 to 199,146 tons in 1929). On the other hand, sales of roofing asphalt in the Indiana-Illinois district increased 60.3 per cent (from 225,234 short tons in 1928 to 360,968 tons in 1929) and in California 8.7 per cent (from 137,914 short tons in 1928 to 149,852 tons in 1929).

From data obtained by the Bureau of the Census in its biennial survey of the manufacturing industries the distribution of 968,401 short tons of asphalt consumed by roofing factories in 1929 may be determined. Of the 779,352 short tons known to have been bought by roofing factories in the Northeastern district, 420,900 tons was consumed in Illinois, 120,441 tons in New Jersey, 68,745 tons in Ohio, 51,358 tons in Pennsylvania, 28,272 tons in New York, and 22,869 tons in Indiana and Michigan. Of the 104,274 tons bought by roofing factories in the Pacific-Rocky Mountain district, 83,590 tons was consumed in California. Factories in Missouri and Louisiana manufacturing prepared roofing consumed 39,400 tons of asphalt in 1929.

The Bureau of the Census reports the manufacture and sale in 1929 of 26,020,929 roofing squares of asphalt roll roofing, valued at $33,952,757; 11,676,636 roofing squares of asphalt shingles, valued at $42,291,342; 135,509 short tons of asphalt-saturated felt, valued at $6,119,890; 35,161 short tons of solid asphalt roof cements, valued at $842,420; 32,331,227 pounds of fibrous plastic roof cement, valued at $1,402,009; 4,873,160 gallons of fibrous liquid roof coating, valued at $2,086,949; and 1,931,270 gallons of nonfibrous liquid roof coating, valued at $1,107,340. Corresponding figures for 1927 and for previous years are not available. The total value of roofing materials shipped from factories in the United States declined 10.6 per cent (from $105,376,087 in 1927 to $94,240,652 in 1929). The foregoing totals do not include roofing materials valued at $9,959,321 in 1927 made as secondary products by establishments classified in other industries and valued at $3,244,019 in 1929.

Most of the asphalt-saturated felt sold by the roofing manufacturers is used in the manufacture of asphalted felt-base floor coverings, an industry that absorbs each year indirectly an increasing tonnage of asphalt. These floor coverings are made of a rag felt, similar to but somewhat better in grade than roofing felt, saturated with hot asphalt, coated on the underside with paint, and printed on the wearing surface with an ornamental design in color.[6] According to the Bureau of the Census, 113,823,600 square yards of asphalted felt-base floor coverings, valued at $36,051,099, were manufactured in 1929. This quantity represented an increase of 1.8 per cent over the 111,793,136 square yards, valued at $34,900,255, manufactured in 1927; of 46.1 per cent over the 77,888,999 square yards, valued at $30,029,431, manufactured in 1925; and of 60.1 per cent over the 71,076,078 square yards, valued at $30,239,508, manufactured in 1923. It is estimated that the manufacture of asphalted felt-base floor coverings consumed indirectly 91,000 short tons of asphalt in 1929, chiefly in the form of saturated felt purchased from manufacturers of roofing.

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[6] U. S. Tariff Commission, Linoleum, Felt-Base Floor Coverings, Floor Oilcloth, and Rubber Tile, Tariff Information Surveys on Paragraphs 1020 and 1022 of the Tariff Act of 1922, pp. 33-37, Washington: 1929.

There was a marked shift in the manufacture of roofing asphalt from the Atlantic coast and the Gulf coast to the Middle West. More than one-third (34.3 per cent) of all roofing asphalt sold in the United States in 1929 came from refineries of the Indiana-Illinois district, which sold only 19.7 per cent of the national total in 1928. On the other hand, refineries of the East coast district sold only 26.6 per cent of the total in 1929, as compared with 37.1 per cent in 1928, and refineries of the Gulf coast only 18.9 per cent in 1929, as compared with 28.8 per cent in 1928. The share of California refineries in the national total remained practically constant, amounting to 14.2 per cent in 1929 and 12.0 per cent in 1928.

Sales of roofing flux increased 55.6 per cent in tonnage (from 266,691 short tons in 1928 to 414,983 tons in 1929) and 25.7 per cent in value (from $3,017,085 in 1928 to $3,792,112 in 1929). The principal gains occurred in the East coast, where 100,341 short tons of roofing flux was sold in 1928 and 233,841 tons in 1929, and in the Gulf coast, where 95,682 tons was sold in 1928 and 104,381 tons in 1929. In the Indiana-Illinois district sales of roofing flux decreased from 70,523 tons in 1928 to 61,287 tons in 1929.

MINOR USES

Sales of waterproofing asphalt decreased 22.7 per cent in quantity (from 136,456 short tons in 1928 to 105,441 tons in 1929) and 26.4 per cent in value (from $1,863,969 in 1928 to $1,371,717 in 1929). The decrease was greatest in the East coast district (from 69,128 tons in 1928 to 41,758 tons in 1929) and in California (from 37,525 tons in 1928 to 26,710 tons in 1929). In the Gulf coast refining district, however, sales of waterproofing asphalt increased from 27,197 tons in 1928 to 36,970 tons in 1929.

Sales of asphalt for blending with rubber increased 17.1 per cent in quantity (from 21,674 short tons in 1928 to 25,324 tons in 1929) and 3.9 per cent in value (from $306,426 in 1928 to $317,871 in 1929). Ninety-two per cent of the asphalt sold in the United States in 1928 for blending with rubber came from refineries of the East coast district, and 89.4 per cent in 1929.

Statistics of asphalt sales for a number of minor uses were made available for the first time for the year 1929.

Asphalt sold as a binder for molding coal dust or coke breeze into briquets amounted in 1929 to 65,135 short tons, valued at $696,707. The greater part of this tonnage was made in the Indiana-Illinois refining district.

Asphalt mastic is an artificial mixture of 10 to 15 per cent of asphalt with mineral matter of suitable fineness and uniformity. When heated it forms a thick, slowly moving mass which may be poured into place and smoothed by hand troweling. It is therefore suitable for laying floors in dwellings, office buildings, warehouses, and factories; for roofs, channels, and gutters; and for lining drains, tanks, vats, and absorption and reaction chambers. Sales of asphalt mastic and mastic cake by petroleum refineries amounted in 1929 to 1,789 short tons, valued at $30,081. In addition, 82 tons of mastic flux, valued at $678, was sold by petroleum refineries.

Sales of asphalt for coating pipes to protect them from rust and corrosion amounted in 1929 to 12,782 short tons, valued at $199,868. These figures refer only to sales by petroleum refineries and do not include pipe coatings made by other manufacturers from asphalts purchased from the petroleum refineries.

Asphalt mixed variously with resins, vulcanized rubber, and fibers is molded into electric fittings, pushbuttons, knobs, handles, joints, washers, battery boxes, and many other small articles, as well as artificial lumber and flooring planks. Most of the 2,279 short tons of asphalt, valued at $24,995, sold in 1929 for molding compounds came from the East coast district.

For use in road surfacing, for cold-patching streets and highways, some asphalts are softened or even liquefied by the addition of lighter fractions of petroleum as solvents. When the mixture is applied to the road surface the solvent evaporates, leaving behind a coating of asphalt. Such softened or liquefied asphalts are known as "cut-back" asphalts. Sales of cut-back asphalts by petroleum refineries amounted in 1929 to 129,695 short tons, valued at $1,674,246. Of the total sales, 96,564 tons, valued at $1,210,164, came from the East coast; 11,330 tons, valued at $149,240, from the Gulf coast district; and most of the remainder from the Indiana-Illinois district.

Another form of liquefied asphalt ready for immediate application to a road or street surface, for waterproofing or dampproofing walls, for coating and saturating felt and building paper, is the asphalt emulsion, of which many types have been patented. Such emulsions are mechanical mixtures of 45 to 75 per cent of asphalt with water and an emulsifying agent, usually a soap or a colloidal clay. In most types the asphalt is dispersed in the water in the form of exceedingly fine droplets or globules, about 1/5000 to 1/10000 inch in diameter, each coated with a thin film of the emulsifying agent. When applied to the road surface or to the object to be coated the emulsion breaks down, the water evaporates or is absorbed, and the asphalt particles unite to form an adherent coating. In 1929 petroleum refineries sold 14,810 short tons of emulsified asphalts, valued at $181,264. No data are available to indicate the quantity or value of emulsified asphalt made by other manufacturers from asphalt bought from petroleum refineries. (It is estimated that from three to four times as much emulsified asphalt as is made in petroleum refineries is manufactured by other industrial establishments.)

Only 210 short tons of asphalt, valued at $6,653, was sold by petroleum refineries in 1929 in the form of paints, varnishes, japans, and lacquers. No statistics are at hand to show the quantity of asphaltic paints, varnishes, enamels, japans, or lacquers made by other manufacturers from asphalt purchased from petroleum refiners.

SALES BY DISTRICTS

EAST COAST DISTRICT

Forty-eight per cent of the asphalt (exclusive of road oil) sold in the United States in 1928 and 45 per cent of that sold in 1929 came from refineries situated along the Atlantic seaboard. Total sales of asphaltic products by refineries of the East coast district increased 3.1 per cent in quantity from 1928 to 1929 but decreased 10.9 per cent in value. The chief and almost the only increase was in roofing flux, which increased 133.0 per cent in tonnage sold and 75.4 per cent in value obtained from sales. On the other hand, solid and semisolid asphalts of less than 200 penetration decreased 10.2 per cent in tonnage and 22.3 per cent in value. The tonnage of paving asphalt sold changed little from 1928 to 1929, but the value obtained was 11.9 per cent less in 1929 than in 1928. Sales of roofing asphalt decreased 34.2 per cent in tonnage and 36.4 per cent in value. Sales of waterproofing asphalt declined 39.6 per cent in quantity and 51.2 per cent in value. Asphalt for blending with rubber increased 13.1 per cent in tonnage but decreased 8.0 per cent in value.

Paving asphalt formed 49.1 per cent of the total tonnage sold by East coast refineries in 1928 and 47.6 per cent in 1929. It supplied 49.2 per cent of the total income realized from asphalt sales in 1928 and 48.6 per cent in 1929. On the other hand, sales of roofing asphalt constituted 24.9 per cent of the total tonnage sold in 1928 but only 15.9 per cent of that sold in 1929. It furnished 23.9 per cent of the total values realized by asphalt sales in the East coast district in 1928, but only 17.1 per cent in 1929. Of the semisolid and liquid asphalts of less than 200 penetration, paving flux decreased in importance from 6.1 per cent of the total tonnage in 1928 to 5.4 per cent in 1929, but increased from 7.6 per cent of the total value in 1928 to 8.7 per cent in 1929. Roofing flux constituted 5.9 per cent of the total tonnage of asphalt sold in the East coast district in 1928 and 13.3 per cent in 1929. It returned 5.5 per cent of the total income realized by asphalt sales in the East coast district in 1928 and 10.8 per cent in 1929.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries of the East coast district, 1928 and 1929, by varieties

	1928		1929	
	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:				
Asphalt for—				
Paving	837,873	$11,539,278	837,012	$10,170,549
Roofing	424,918	5,607,461	279,769	3,568,458
Waterproofing	69,128	1,011,540	41,758	494,090
Blending with rubber	20,032	268,265	22,651	246,856
Briquetting	(1)	(1)	11,182	135,218
Miscellaneous uses	71,939	953,190	86,219	437,916
	1,423,890	19,379,734	1,278,591	15,053,087

[1] No data available.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries of the East coast district, 1928 and 1929, by varieties—Continued

	1928		1929	
	Short tons	Value	Short tons	Value
Semisolid and liquid products of more than 200 penetration:				
Flux for—				
Paving	103,586	$1,793,605	95,221	$1,816,133
Roofing	100,341	1,290,061	233,841	2,262,399
Waterproofing	245	10,236	----------	----------
Cut-back asphalts	(1)	(1)	96,564	1,210,164
Other liquid products	77,640	995,232	53,804	579,822
	281,812	4,089,134	479,430	5,868,518
Grand total	1,705,702	23,468,868	1,758,021	20,921,605

[1] No data available.

GULF COAST DISTRICT

Gulf coast refineries sold 21.6 per cent of the asphalt sold in the United States in 1928 but only 17.5 per cent in 1929. Sales of petroleum asphalt by refineries of the Gulf coast district of Louisiana and Texas decreased 11.9 per cent in tonnage (from 770,739 short tons in 1928 to 679,054 tons in 1929) and 24.9 per cent in value (from $10,257,272 in 1928 to $7,699,132 in 1929). The principal decrease was in sales of roofing asphalt, which dropped 39.6 per cent in tonnage and 49.2 per cent in value. At the same time, sales of paving asphalt decreased 2.8 per cent in tonnage and 19.1 per cent in value. On the other hand, sales of waterproofing asphalt increased 35.9 per cent in quantity and 23.6 per cent in value.

Although sales of paving asphalt decreased somewhat in tonnage, they gained in relative importance because of the general decrease in the tonnage of asphalt sold by refineries of the Gulf coast. Sales of paving asphalt constituted 35.5 per cent of the total tonnage and yielded 41.7 per cent of the total sales income in 1928, but 39.2 per cent of the tonnage and 45.0 per cent of the total value in 1929. At the same time, sales of roofing asphalt decreased in importance from 42.8 per cent of the total tonnage and 39.0 per cent of the total value in 1928 to 29.3 per cent of the total tonnage and 26.4 per cent of the total value in 1929. The drop of 39.6 per cent in the tonnage of roofing asphalt sold by Gulf coast refineries, taken in connection with an increase of 60.3 per cent in sales of roofing asphalt by refineries of the Indiana-Illinois district, indicates that the factories making prepared roofing in Illinois, Indiana, and Ohio are receiving a greater part of their asphalt supply from the Indiana-Illinois refineries and a smaller part by rail from the Gulf coast refineries. On the other hand, sales of waterproofing asphalt increased in importance from 3.5 per cent of the total tonnage and 3.8 per cent of the total value in 1928 to 5.4 per cent of the total tonnage and 6.3 per cent of the total value in 1929.

Of the semisolid and liquid asphalts, paving flux gained in importance from 1.7 per cent of the total tonnage of asphalt sold and 2.3 per cent of the total value received in 1928 to 6.2 per cent of the total tonnage and 6.1 per cent of the value received in 1929. Roofing flux formed 12.4 per cent of the total tonnage sold and yielded 9.3 per cent of the total value obtained in 1928 and 15.4 per cent of the total tonnage sold and 10.6 per cent of the total value in 1929.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries of the Gulf coast district, 1928 and 1929, by varieties

	1928		1929	
	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:				
Asphalt for—				
Paving	273, 742	$4, 275, 310	266, 237	$3, 461, 044
Roofing	329, 700	4, 005, 443	199, 146	2, 035, 368
Waterproofing	27, 197	393, 184	36, 970	485, 844
Pipe coatings	(1)	(1)	5, 417	82, 129
Miscellaneous uses	31, 379	392, 674	11, 868	187, 634
	662, 018	9, 066, 611	519, 638	6, 252, 019
Semisolid and liquid products of more than 200 penetration:				
Flux for—				
Paving	12, 790	239, 788	42, 236	469, 132
Roofing	95, 682	949, 013	104, 381	815, 796
Cut-back asphalts	(1)	(1)	11, 330	149, 240
Other liquid products	249	1, 860	1, 469	12, 945
	108, 721	1, 190, 661	159, 416	1, 447, 113
Grand total	770, 739	10, 257, 272	679, 054	7, 699, 132

[1] No data available.

INDIANA-ILLINOIS DISTRICT

From 11.9 per cent in 1928, the share of the Indiana-Illinois district grew to 16.1 per cent in 1929. Asphaltic products sold by refineries of the Indiana-Illinois district increased 47.0 per cent in quantity (from 424,917 short tons in 1928 to 624,780 tons in 1929) but only 26.1 per cent in value (from $4,399,827 in 1928 to $5,547,834 in 1929). The principal gain occurred in sales of roofing asphalt. There were minor increases in sales of briquetting asphalt, miscellaneous solid asphalts, paving flux, and roofing flux.

Roofing asphalt was the principal grade of asphalt sold by the Indiana-Illinois refineries. It constituted 53.0 per cent of the total tonnage sold in 1928 and 57.8 per cent of the tonnage sold in 1929. In addition, sales of roofing flux formed 16.6 per cent of the total tonnage in 1928 and 9.8 per cent in 1929. Paving asphalt made up only 13.7 per cent of the total tonnage in 1928 and 7.7 per cent in 1929 and paving flux 2.1 per cent of the total tonnage in 1928 and 2.3 per cent in 1929.

From the standpoint of value, also, roofing asphalt led in the refinery sales of the Indiana-Illinois district. It furnished 49.0 per cent of the total returns from sales in 1928 and 53.0 per cent in 1929. Roofing flux furnished an additional 17.6 per cent in 1928 and 9.1 per cent in 1929. Paving asphalt returned 16.5 per cent of the total sales revenue in 1928 and 8.8 per cent in 1929.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries of the Indiana-Illinois district, 1928 and 1929, by varieties

	1928		1929	
	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:				
Asphalt for—				
Paving	58,027	$725,234	48,098	$490,126
Roofing	225,234	2,154,476	360,968	2,941,654
Miscellaneous uses	60,380	604,045	103,443	1,020,991
	343,641	3,483,755	512,509	4,452,771
Semisolid and liquid products of more than 200 penetration:				
Flux for—				
Paving	9,013	88,568	14,491	113,717
Roofing	70,523	776,225	61,287	504,551
Other liquid products	1,740	51,279	36,493	476,795
	81,276	916,072	112,271	1,095,063
Grand total	424,917	4,399,827	[1] 624,780	5,547,834

[1] Does not include 53,233 tons of asphalt consumed by the producing companies.

CALIFORNIA DISTRICT

Pacific coast refineries sold 17.5 per cent of the total sales of asphalt in 1928 and 17.2 per cent in 1929. Sales of petroleum asphalt by California refineries increased 7.1 per cent in tonnage (from 623,883 short tons in 1928 to 668,321 tons in 1929) and 13.6 per cent in value (from $7,628,944 in 1928 to $8,668,712 in 1929). The average value per short ton increased 6.1 per cent (from $12.23 in 1928 to $12.97 in 1929). The chief increases were in sales of roofing asphalt and in paving and roofing flux, which had not been previously manufactured in California.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries of California, 1928 and 1929, by varieties

	1928		1929	
	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:				
Asphalt for—				
Paving	365,798	$4,561,971	351,765	$4,564,548
Roofing	137,914	1,906,076	149,852	2,544,222
Waterproofing	37,525	430,747	26,710	391,732
Miscellaneous uses	11,835	199,067	17,087	277,081
	553,072	7,097,861	545,414	7,777,583
Semisolid and liquid products of more than 200 penetration:				
Flux for—				
Paving			32,721	343,608
Roofing			15,474	209,366
Other liquid products	70,811	531,083	74,712	338,155
	70,811	531,083	122,907	891,129
Grand total	623,883	7,628,944	668,321	8,668,712

Sales of paving asphalt in California refineries decreased 3.8 per cent in tonnage but increased slightly in value. The average sales value per ton increased 4.1 per cent (from $12.47 in 1928 to $12.97 in 1929). At the same time, sales of roofing asphalt increased 8.7 per cent in tonnage and 33.5 per cent in value. The average sales value per ton rose 22.9 per cent (from $13.82 in 1928 to $16.98 in 1929). On the other hand, sales of waterproofing asphalt decreased 28.8 per cent in tonnage but only 9.1 per cent in value. The sales value per short ton averaged $11.48 in 1928 and $14.67 in 1929, an increase of 27.8 per cent.

Although paving asphalt continued to be the most important variety of asphalt sold by California refineries in 1929, its relative importance decreased somewhat in comparison to that of roofing asphalt. Paving asphalt constituted 58.6 per cent of the tonnage of asphalt sold in California in 1928 but only 52.6 per cent in 1929. It furnished 59.8 per cent of the total revenue realized from asphalt sales in California in 1928 but only 52.7 in 1929. On the other hand, roofing asphalt gained in importance, rising from 22.1 per cent of the total tonnage sold in 1928 to 22.4 per cent in 1929 and from 25.0 per cent of the total income from asphalt sales in California in 1928 to 29.3 per cent in 1929. Waterproofing asphalt declined in relative rank, falling from 6.0 per cent of the total tonnage sold in 1928 to 4.0 per cent in 1929 and from 5.6 per cent of the total value realized from the sales in 1928 to 4.5 per cent in 1929.

DISTRIBUTION BY RAIL

Nine-tenths of the total tonnage of petroleum and lake asphalt available for distribution in 1929 was distributed in the United States by rail. Shipments of asphalt (natural, by-product, or petroleum) originating on Class I railroads in the United States increased 10.2 per cent (from 2,899,326 short tons in 1928 to 3,196,392 tons in 1929), according to statistics compiled and published by the Interstate Commerce Commission. Similarly, the quantity of asphalt terminated by Class I railroads increased 10 per cent (from 2,987,075 short tons in 1928 to 3,284,364 tons in 1929). The total volume of asphalt handled by Class I railroads amounted to 6,414,948 short tons in 1928 and 6,888,441 tons in 1929, an increase of 7.4 per cent. The latter figures involve considerable duplication of tonnage, as much asphalt is transferred from one railroad system to one or more other systems. Shipments of asphalt contributed $12,818,735 to the revenue of the railroads hauling them in 1928 and $13,712,067 in 1929, a gain of 7.0 per cent.

Asphalt shipments originating on Class I railroads in the United States, 1927–1929, by regions, in short tons [1]

Region	1927	1928	1929
Eastern district:			
New England	139,795	157,588	173,353
Great Lakes	162,517	192,961	217,654
Central Eastern	1,096,610	1,247,480	1,539,635
Total Eastern district	1,398,922	1,598,029	1,930,642
Southern district:			
Pocahontas	25,119	35,399	47,551
Southern	899,224	668,452	571,334
Total Southern district	924,343	703,851	618,885
Western district:			
Northwestern	61,529	19,669	29,933
Central Western	289,931	286,533	338,516
Southwestern	495,171	291,244	278,416
Total Western district	846,631	597,446	646,865
Total United States	3,169,896	2,899,326	3,196,392

[1] Source: Freight Commodity Statistics, Interstate Commerce Commission.

The principal increase took place in the Central Eastern district, where original shipments of asphalt on Class I railroads amounted to 1,096,610 short tons in 1927, to 1,247,480 tons in 1928, and to 1,539,635 tons in 1929. Similarly, shipments originating on railroads of the Great Lakes district increased from 162,517 short tons in 1927 to 192,961 tons in 1928 and 217,654 tons in 1929. At the same time, shipments originating on railroads of the Southeastern States other than Virginia and West Virginia decreased from 899,224 short tons in 1927 to 668,452 tons in 1928 and 571,334 tons in 1929. Shipments originating on railroads of the Southwestern States south of St. Louis and Kansas City decreased from 495,171 short tons in 1927 to 291,244 tons in 1928 and 278,416 tons in 1929. These various increases and decreases indicate a decreasing movement of asphalt from the Gulf coast refineries of Texas and Louisiana up the Mississippi Valley to Illinois, Indiana, and Ohio, and an increasing dependence of the Ohio Valley States on asphalt from their own refineries.

The tank cars used for shipping asphalt carried lighter loads in 1929 than in 1928 or 1927. The average carload of asphalt originating on Class I railroads in the United States, which averaged 33.3 short tons from 1920 to 1924, inclusive, and had increased to 35.9 tons in 1927, decreased to 34.4 tons in 1928 and 34.1 tons in 1929.

The seasonal nature of the demand for asphalt is illustrated by shipments originating on Class I railroads. The smallest shipments are made in the first quarter of the year. These amounted to only 15.7 per cent of the annual total in 1927, only 14.0 per cent in 1928, and only 14.5 per cent during 1929. During the second quarter 26.9 per cent of the annual total was shipped in 1927, 29.1 per cent in 1928, and 28 3 per cent in 1929. The largest shipments were made during the third quarter—33.5 per cent of the yearly total in 1927, 34.5 per cent in 1928, and 35.3 per cent in 1929. In the fourth quarter 23.9 per cent of the tonnage hauled in 1927 was shipped, 22.4 per cent in 1928, and 21.9 per cent in 1929.

Asphalt shipments originating on Class I railroads in the United States, 1926–1929, in short tons[1]

	1926	1927	1928	1929
Eastern district:				
Baltimore & Ohio	190, 057	202, 640	227, 349	247, 580
Central of New Jersey	295, 048	326, 773	359, 019	379, 521
Elgin, Joliet & Eastern	63, 778	68, 966	89, 958	142, 169
Lehigh Valley	124, 298	122, 753	118, 781	116, 872
New York Central	17, 030	20, 801	34, 638	41, 294
New York, New Haven & Hartford	119, 004	138, 604	147, 478	167, 729
Pennsylvania	373, 443	310, 899	325, 843	366, 694
Other railroads	211, 142	207, 486	294, 963	468, 783
Total Eastern district	1, 393, 800	1, 398, 922	1, 598, 029	1, 930, 642
Southern district:				
Atlantic Coast Line	100, 037	82, 385	64, 744	35, 671
Illinois Central	74, 027	119, 302	63, 570	85, 777
Louisville & Nashville	174, 637	199, 299	79, 843	25, 835
Seaboard Air Line	58, 349	52, 296	26, 384	28, 880
Southern	64, 223	53, 919	44, 867	65, 472
Yazoo & Mississippi Valley	358, 654	359, 131	358, 117	306, 181
Other railroads	65, 009	58, 011	66, 326	71, 069
Total Southern district	894, 936	924, 343	703, 851	618, 885
Western district:				
Atchison, Topeka & Santa Fe	68, 456	49, 594	48, 104	50, 970
Chicago & Alton	42, 027	51, 296	75, 552	116, 475
Chicago & North Western	49, 529	52, 757	6, 680	6, 207
Chicago, Burlington & Quincy	48, 068	41, 131	29, 933	41, 482
Gulf, Colorado & Santa Fe	31, 312	28, 108	819	720
Louisiana Railway & Navigation Co	61, 614	37, 105	67, 837	40
San Antonio, Uvalde & Gulf	99, 280	219, 680	41, 788	23, 402
Southern Pacific (Pacific Lines)	152, 696	137, 356	104, 392	107, 755
Southern Pacific (lines in Texas and Louisiana)	100, 871	39, 634	5, 287	4, 498
Texarkana & Fort Smith	106, 650	137, 671	136, 368	144, 752
Other railroads	51, 715	52, 299	80, 686	150, 564
Total Western district	812, 218	846, 631	597, 446	646, 865
Total United States	3, 100, 954	3, 169, 896	2, 899, 326	3, 196, 392

[1] Freight Commodity Statistics, Interstate Commerce Commission. In the statistics for 1928 and 1929 the material carried was designated as "asphalt (natural, by-product, or petroleum)"; in those for 1926 and 1927, merely as "asphaltum."

The greatest absolute increase in the tonnage of asphalt terminated took place in the Central Eastern region, where 933,113 short tons was terminated in 1928 and 1,095,102 tons in 1929, an increase of 17.4 per cent. Second in rank was the Great Lakes region, where 631,319 short tons was terminated in 1928 and 716,873 tons in 1929, an increase of 13.6 per cent, and third the New England region, where 208,773 short tons was terminated in 1928 and 230,281 tons in 1929, an increase of 10.3 per cent. The greatest relative increase, 43.9 per cent, was in the Pocahontas region, where 29,459 short tons was terminated in 1928 and 42,406 tons in 1929. Asphalt terminated in the Northwestern region increased 40.9 per cent (from 141,684 short tons in 1928 to 199,648 tons in 1929). On the other hand, asphalt terminated by railroads of the Southern region decreased 7.1 per cent from 1928 to 1929, of the Southwestern region 2.3 per cent, and of the Central Western region 1.5 per cent.

Asphalt terminated by Class I railroads in the United States, 1928 and 1929, by regions, in short tons[1]

Region	1928	1929
Eastern district:		
New England	208, 773	230, 281
Great Lakes	631, 319	716, 873
Central Eastern	933, 113	1, 095, 102
Total Eastern district	1, 773, 205	2, 042, 256
Southern district:		
Pocahontas	29, 459	42, 406
Southern	451, 470	419, 527
Total Southern district	480, 929	461, 933
Western district:		
Northwestern	141, 684	199, 648
Central Western	367, 674	362, 054
Southwestern	223, 583	218, 473
Total Western district	732, 941	780, 175
Total United States	2, 987, 075	3, 284, 364

[1] Source: Freight Commodity Statistics, Interstate Commerce Commission.

Of the individual railroads operating in the Eastern district, the largest increases in the tonnage of asphalt terminated were shown by the New York Central, the Erie, the Pennsylvania, the Baltimore & Ohio, the Elgin, Joliet & Eastern, the New York, New Haven & Hartford, and the Cleveland, Cincinnati, Chicago & St. Louis. The only important decrease occurred on the Lehigh Valley System.

In the Southern district the principal decreases in the tonnage of asphalt terminated from 1928 to 1929 were on the Mobile & Ohio, the Atlantic Coast Line, and the Louisville & Nashville. On the other hand, there were important gains in the tonnage of asphalt terminated in 1929 by the Nashville, Chattanooga & St. Louis, the Norfolk & Western, and the Illinois Central.

In the Northwestern region the chief gains in asphalt terminated in 1929 over 1928 were made by the Great Northern, the Northern Pacific, the Chicago, Milwaukee, St. Paul & Pacific, the Chicago, St. Paul, Minneapolis & Omaha, and the Chicago & North Western.

In the Central Western region the only important increase was made by the Southern Pacific lines in California. On the other hand, considerably less asphalt was terminated by the Chicago, Rock Island & Pacific and less by the Atchison, Topeka & Santa Fe in 1929 than in 1928.

Asphalt terminated by Class I railroads in the United States, 1928 and 1929, in short tons[1]

	1928 (total)	1929		
		Originating on carriers' lines	Received from connecting carriers	Total
Eastern district:				
Baltimore & Ohio	229, 712	104, 249	147, 963	252, 212
Central of New Jersey	58, 786	49, 807	7, 068	56, 875
Cleveland, Cincinnati, Chicago & St. Louis	46, 322	20, 532	37, 733	58, 265
Elgin, Joliet & Eastern	88, 770	25, 610	84, 773	110, 383
Erie	128, 069	4, 540	150, 885	155, 425
Lehigh Valley	70, 233	27, 189	20, 739	47, 928
Michigan Central	57, 709	1, 340	53, 636	54, 976
New York Central	177, 177	21, 580	183, 181	204, 761
New York, New Haven & Hartford	161, 359	140, 000	40, 302	180, 302
Pennsylvania	345, 338	245, 433	125, 310	370, 743
Other railroads	409, 730	82, 918	467, 468	550, 386
Total Eastern district	1, 773, 205	723, 198	1, 319, 058	2, 042, 256
Southern district:				
Atlantic Coast Line	37, 633	19, 354	4, 234	23, 588
Florida East Coast	31, 512	2, 402	29, 614	32, 016
Illinois Central	113, 143	14, 243	107, 460	121, 703
Louisville & Nashville	35, 169	5, 636	23, 053	28, 689
Mobile & Ohio	33, 964	467	11, 965	12, 432
Nashville, Chattanooga & St. Louis	14, 237	92	34, 335	34, 427
Norfolk & Western	13, 426	6, 686	15, 936	22, 622
Seaboard Air Line	20, 638	14, 604	5, 821	20, 425
Southern	52, 191	24, 174	26, 622	50, 796
Yazoo & Mississippi Valley	43, 230	39, 388	4, 548	43, 936
Other railroads	85, 786	3, 101	68, 198	71, 299
Total Southern district	480, 929	130, 147	331, 786	461, 933
Western district:				
Atchison, Topeka & Santa Fe	66, 056	44, 422	17, 028	61, 450
Chicago & Alton	65, 982	49, 945	15, 784	65, 729
Chicago & North Western	28, 604	4, 280	31, 884	36, 164
Chicago, Burlington & Quincy	22, 562	5, 584	18, 743	24, 327
Chicago Great Western	8, 019	1, 062	15, 168	16, 230
Chicago, Milwaukee, St. Paul & Pacific	33, 520	2, 738	42, 179	44, 917
Chicago, Rock Island & Pacific	72, 146	3, 505	52, 301	55, 806
Chicago, St. Paul, Minneapolis & Omaha	12, 722	5	19, 936	19, 941
Great Northern	21, 936	4, 681	35, 358	40, 039
International Great Northern	15, 257	301	7, 217	7, 518
Kansas City Southern	16, 099	394	13, 555	13, 949
Louisiana & Arkansas	235	20, 823	591	21, 414
Louisiana Railway & Navigation Co	14, 705	18	2, 900	2, 918
Missouri Pacific	43, 339	6, 859	44, 027	50, 886
Northern Pacific	13, 854	5, 003	23, 040	28, 043
St. Louis-San Francisco	17, 532	1, 527	13, 926	15, 453
Southern Pacific	87, 178	86, 195	11, 192	97, 387
Texarkana & Fort Smith	24, 734	25. 343	315	25, 658
Texas & New Orleans	29, 308	3, 685	19, 193	22, 878
Other railroads	139, 153	9, 571	119, 897	129, 468
Total Western district	732, 941	275, 941	504, 234	780, 175
Total United States	2, 987, 075	1, 129, 286	2, 155, 078	3, 284, 364

[1] Source: Freight Commodity Statistics, Interstate Commerce Commission.

In the Southwestern region decreases in the tonnage of asphalt terminated by the Louisiana Railway & Navigation Co. system, the International Great Northern, the Texas & New Orleans, the Kansas City Southern, and the St. Louis-San Francisco were practically balanced by increases in asphalt terminated by the Louisiana & Arkansas and the Missouri Pacific.

DISTRIBUTION BY WATER

Less than one-tenth of all asphalts—petroleum, lake, and natural rock—appears to have been shipped in domestic commerce by water in 1929. No complete statistics of coastwise or river shipments of asphalt are at hand. The Board of Engineers for Rivers and Harbors of the United States Army collects statistics of freight shipped over waterways improved with the aid of Federal funds. The figures of domestic commerce, as published, show for each harbor or waterway chiefly shipments and receipts in coastwise traffic, intraport shipments and receipts, and transit trade. No information is available to show the origin of freight received or the destination of freight shipped; and the data are insufficient to permit striking a balance between shipments from the Pacific coast to the Gulf and Atlantic coasts or vice versa. Nevertheless, such figures as are available aid in showing the coastwise movement of asphalt in domestic commerce.

The principal coastwise movements of asphalt in domestic commerce are from San Francisco to various points on the Pacific coast and through the Panama Canal to Gulf and Atlantic ports, and from Beaumont and Port Arthur, Tex., to various points on the Gulf and Atlantic coasts. Coastwise shipments from Pacific ports increased from 47,532 short tons in 1926 to 108,305 tons in 1929. On the other hand, coastwise shipments from ports on the Gulf coast west of the Mississippi River decreased from a maximum of 135,726 short tons in 1927 to 104,254 tons in 1929.

According to statistics compiled by the San Francisco office of the Bureau of Mines, shipments of asphalt from California through the Panama Canal to Atlantic and Gulf ports amounted to 14,000 barrels (about 2,500 short tons) in 1926; to 17,000 barrels (3,000 tons) in 1927; to 29,000 barrels (5,300 tons) in 1928; and to 28,000 barrels (5,100 tons) in 1929. Figures compiled by the Bureau of Research, United States Shipping Board, show receipts from Pacific ports of 1,150 short tons of asphalt at New York during the calendar year 1929, of 435 tons at Baltimore, and of 103 tons at Philadelphia. In addition, 2,708 short tons of asphalt was shipped to Pacific ports in 1929 from New York, Baltimore, and Boston and 1,827 tons from Beaumont, Port Arthur, and Port Neches, Tex., and New Orleans, La.

Asphalt shipped by water in coastwise traffic, 1926–1929, by regions, in short tons[1]

Region	1926	1927	1928	1929
New York harbor and vicinity	2,702	2,269	1,800	5,538
Middle Atlantic ports	276	74	51	111
South Atlantic ports				103
East Gulf ports	161	18	9	27,605
West Gulf ports	119,323	135,726	116,849	104,254
Pacific ports	47,532	26,329	94,965	108,305
	169,994	164,416	213,674	245,916

[1] Source: Annual Reports, Chief of Engineers, U. S. Army.

Although coastwise shipments of asphalt are recorded that range in quantity from 164,416 short tons in 1927 to 245,916 tons in 1929, the total known receipts of asphalt in coastwise traffic averaged less than one-third of the recorded shipments. Undoubtedly many shipments of asphalt are made to road-building and construction jobs away from commercial harbors, where no record is made of their receipt.

Asphalt received by water in coastwise traffic, 1926–1929, by regions, in short tons [1]

Region	1926	1927	1928	1929
New England ports	1, 306	886	400	28, 304
New York harbor and vicinity	1, 190	1, 599	2, 628	4, 577
Middle Atlantic ports	14, 563	19, 598	34, 077	18, 109
South Atlantic ports	2, 279	6, 688	7, 402	15, 304
East Gulf ports	2, 835	10, 796	4, 679	3, 696
West Gulf ports	1, 296	310	1, 063	4, 385
North Pacific ports	6, 405	2, 693	9, 892	5, 889
South Pacific ports	9, 079	10, 486	14, 525	7, 922
	38, 953	53, 056	74, 666	88, 186

[1] Source: Annual Reports, Chief of Engineers, U. S Army.

From 90,000 to 300,000 short tons of asphalt is distributed by water within the harbor area of New York and from 17,000 to 38,000 tons within the harbor area of San Francisco. Although the available statistics of such intraport shipments and intraport receipts by no means tally, the following figures of intraport receipts will give some idea of the relative importance of this traffic.

Asphalt received by water in intraport traffic, 1926–1929, by regions, in short tons [1]

Region	1926	1927	1928	1929
New York harbor and vicinity	207, 388	304, 901	90, 326	188, 135
Philadelphia harbor	929	128	325	3, 343
San Francisco harbor	29, 552	37, 644	17, 268	19, 107
	237, 869	342, 673	107, 919	210, 585

[1] Source: Annual Reports, Chief of Engineers, U. S. Army.

CONSUMPTION BY DISTRICTS

The consumption of asphalt tends to be concentrated to an increasing degree in the Northeastern district, so far as the regional distribution of asphalts can be determined from the statistical data available. From 48.9 per cent in 1926 the share of the Northeastern district in the national consumption has grown to 58.6 per cent in 1929. On the other hand, although the actual tonnage of asphalt distributed by rail in the Southeastern and Southwestern districts increased from 1928, their ratio to the national consumption remained practically constant. During the four years under review the share of the Southeastern district in the total tonnage of asphalt distributed by rail decreased from 15.5 per cent in 1926 to 12.8 per cent in 1929. The ratio of the Southwestern district to the national total was 18.1 per cent in 1926 and 13.7 per cent in 1929. In the North Central and Pacific-Rocky Mountain districts the consumption of asphalt apparently decreased both in tonnage and in relative rank. After increasing from 6.4 per cent in 1926 to 7.5 per cent in 1928 the share of the North Central district dropped to 5.3 per cent in 1929. In the Pacific-Rocky Mountain district the ratio of the regional consumption to the national total was 11.2 per cent in 1926, but only 9.6 per cent in 1929.

Asphalt (petroleum, lake, and natural rock), exclusive of road oil, distributed by rail within districts in the United States, 1926–1929, in short tons

District	1926	1927	1928	1929
Northeastern	1,732,444	2,024,181	1,917,546	2,329,758
Southeastern	549,424	536,347	444,867	509,610
Southwestern	640,023	724,527	480,789	545,361
North Central	226,792	258,260	264,014	209,491
Pacific-Rocky Mountain[1]	397,096	382,436	408,620	367,434
	3,545,779	3,925,751	3,515,836	3,961,654

[1] Includes shipments by electric railroads, minor steam railroads, and motor trucks, as well as intraport shipments.

NORTHEASTERN DISTRICT

Three-fourths of the total available asphalt supply in the Northeastern district, lying north of the Potomac and Ohio Rivers and east of the Mississippi and Illinois Rivers, was furnished from 1926 to 1928, inclusive, by petroleum refineries operating within the district itself. The largest of these were situated near New York, Philadelphia, Baltimore, Chicago, and East St. Louis. In 1929, however, with the sharp increase in the production of the Indiana-Illinois refineries, 80.9 per cent of the total available supply came from refineries within the district. The largest single outside source of supply consisted of petroleum asphalt shipped by rail from the Gulf coast refineries up the Mississippi Valley through the Southeastern district. These shipments amounted to 267,000 short tons or 12.1 per cent of the total supply of the Northeastern district in 1926, 271,000 tons or 9.9 per cent of the total supply in 1927, 311,000 tons or 11.7 per cent of the total supply in 1928, but only 170,000 tons or 5.9 per cent of the total supply in 1929. Shipments of rock asphalt from Kentucky and Alabama across the Ohio River may be estimated at from 160,000 to 180,000 tons annually, or at 6 to 7 per cent of the total available asphalt supply of the district. An apparent increase in the tonnage of rock asphalt shipped from Kentucky and Alabama accounts for the greater receipts of asphalt from the Southeastern district in 1929; receipts of petroleum asphalt from the Southwestern district by way of the Southeastern district decreased 45.3 per cent (from 311,000 short tons in 1928 to 170,000 tons in 1929). Imports, chiefly of lake asphalt from Venezuela and Trinidad, decreased both in tonnage and in relative importance. They formed 4.8 per cent of the total available supply in 1926, 4.5 per cent in 1927, but only 3.6 per cent in 1928 and 2.8 per cent in 1929.

Source and distribution of asphalt (petroleum, lake, and natural rock), exclusive of road oil, Northeastern district, 1926–1929, in short tons

	1926	1927	1928	1929
SOURCE				
Produced within district	1,619,521	2,113,933	2,013,355	2,350,837
Received by rail from:				
Southeastern district	427,193	442,815	470,075	350,174
Southwestern district	35,000	40,610	44,501	45,000
Pacific-Rocky Mountain district	2,000	2,500	2,928	26,300
Received by water (coastwise)	15,869	24,944	41,287	52,078
Imported	106,053	123,869	94,699	80,972
	2,205,636	2,748,671	2,666,845	2,905,361
DISTRIBUTION				
Shipped by rail:				
Within district	1,732,444	2,024,181	1,917,546	2,329,758
To North Central district	107,386	126,339	131,384	136,234
To Southeastern district	79,468	75,387	65,034	60,000
To Southwestern district	2,000	3,000	3,754	4,000
Shipped by water (coastwise and river)	219,301	307,244	302,300	194,486
Added to stocks	13,100	5,080	26,820	23,751
Exported	51,937	207,440	220,007	157,132
	2,205,636	2,748,671	2,666,845	2,905,361

Production and consumption of asphalt in the Northeastern district are remarkably well balanced. Three-fourths of the total available supply of the Northeastern district is consumed within the district itself. Receipts of asphalt, both manufactured and natural, from outside sources balance in a general way the shipments of asphalt from the Northeastern district to other sections of the United States and to foreign countries. The principal shipments outside the district were made to the North Central district. These averaged 5 per cent of the total available supply. Shipments, chiefly from refineries of the Baltimore, Philadelphia, and New York districts, to the South Atlantic States, decreased both in quantity and in relative importance. They constituted 3.6 per cent of the total supply in 1926, 2.7 per cent in 1927, 2.4 per cent in 1928, and 2.1 per cent in 1929. Coastwise shipments by water increased from 9.9 per cent of the total in 1926 to 11.2 per cent in 1927 and 11.5 per cent in 1928, but dropped to 6.7 per cent in 1929. Similarly, exports to foreign countries increased from 2.4 per cent of the total in 1926 to 7.5 per cent in 1927 and 8.2 per cent in 1928, but fell off to 5.4 per cent in 1929. Nine-tenths of these exports consisted of petroleum asphalt.

Three-fifths (61.9 per cent) of the bituminous street pavements laid in the United States from 1925 to 1929 were put down in the Northeastern district. According to returns from 113 cities of over 40,000 inhabitants north of the Potomac and Ohio Rivers and east of the Mississippi River and Lake Michigan, the area of city streets paved with asphaltic compounds in the Northeastern district increased from 20,230,775 square yards in 1925 to 21,573,507 square yards in 1926 and 22,534,567 square yards in 1927 but decreased to 21,386,441 square yards in 1928 and 20,008,024 square yards in 1929. Bituminous types of paving constituted 75.7 per cent of the total street pavement laid in the 113 cities of the Northeastern district in 1925, 75.1 per cent in 1926, 69.6 per cent in 1927, 72.0 per cent in 1928, and 73.3 per cent in 1929. Sheet asphalt formed 72.9 per cent of all the bituminous pavements, asphaltic concrete 14.5 per cent, asphaltic penetration macadam 6.9 per cent, and miscellaneous bituminous types 4.5 per cent. Only small percentages of asphalt block and of natural rock asphalt were included in the total.

Street pavement laid in 113 representative cities of the Northeastern district, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	14, 634, 643	15, 740, 390	16, 798, 662	15, 813, 943	14, 047, 248
Asphaltic concrete	3, 230, 736	3, 263, 644	3, 379, 085	2, 951, 764	2, 460, 161
Asphaltic macadam	1, 157, 272	1, 261, 976	1, 113, 494	1, 464, 102	2, 292, 282
Asphalt block	127, 674	180, 831	229, 381	136, 484	77, 885
Natural rock asphalt	88, 209	129, 109	78, 756	111, 617	9, 564
Other asphaltic types	877, 808	958, 502	907, 272	898, 432	1, 110, 884
Tar macadam	114, 433	39, 055	27, 917	10, 099	10, 000
Total bituminous	20, 230, 775	21, 573, 507	22, 534, 567	21, 386, 441	20, 008, 024
Other pavement	6, 480, 482	7, 166, 535	9, 844, 653	8, 325, 165	7, 280, 765
Total pavement	26, 711, 257	28, 740, 042	32, 379, 220	29, 711, 606	27, 288, 789

Nearly half (47.7 per cent) of the bituminous surfaced roads in the United States built and reconstructed from 1925 to 1929 were constructed in the Northeastern district. The new and rebuilt mileage of rural highways surfaced with bituminous compounds in Connecticut, Delaware, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, and Vermont increased from 1,617 miles in 1925 to 2,018 miles in 1929. Bituminous types of surfacing constituted 31.4 per cent of all roadways laid in the Northeastern district in 1925, and 33.9 per cent in 1929. Eighty-two per cent of the bituminous surfacing consisted of penetration macadam, 13.3 per cent of bituminous concrete, and the remainder of sheet asphalt.

Hard-surfaced rural highways built and reconstructed in the Northeastern district, 1925–1929, by types of paving, in miles [1]

Type	1925	1926	1927	1928	1929
Sheet asphalt	94	100	50	81	71
Bituminous concrete	208	288	207	244	264
Bituminous macadam	1, 315	1, 393	1, 416	1, 699	1, 683
Total bituminous	1, 617	1, 781	1, 673	2, 024	2, 018
Other pavement	3, 527	3, 014	3, 299	3, 835	3, 940
Total pavement	5, 144	4, 795	4, 972	5, 859	5, 958

[1] Source: Bureau of Public Roads, Department of Agriculture.

SOUTHEASTERN DISTRICT

Only one-half of all asphalt available for consumption in the Southeastern district, lying south of the Potomac and Ohio Rivers and east of the Mississippi and Pearl Rivers, was obtained from sources within the district. Petroleum refineries at or near Charleston, S. C., Brunswick, Ga., and Parkersburg, W. Va., furnished 16.5 per cent of the total supply in 1926, and 13.9 per cent in 1929. Thirty-five per cent of the total supply consisted of rock asphalt quarried in Kentucky and Alabama. Forty per cent of the total available supply consisted of railroad shipments from the Gulf coast refineries of Louisiana and Texas, largely in transit to Illinois, Indiana, and Ohio. Receipts of petroleum asphalt from refineries near Baltimore, Philadelphia, and New York into the South Atlantic States constituted 7.7 per cent of the total in 1926, but only 6.1 per cent in 1929. Imports, chiefly of lake asphalt from Venezuela and Trinidad, furnished 3.2 per cent of the entire supply over the 4-year period.

Source and distribution of asphalt (petroleum, lake, and natural rock), exclusive of road oil, Southeastern district, 1926–1929, in short tons

	1926	1927	1928	1929
SOURCE				
Produced within district	512,763	518,011	467,246	509,612
Received by rail from:				
Northeastern district	79,468	75,387	65,034	60,000
Southwestern district	398,654	400,191	411,978	352,000
Received by water (coastwise)	7,711	21,427	12,221	21,885
Withdrawn from stocks			1,920	
Imported	34,990	33,061	24,875	35,930
	1,033,586	1,048,077	983,274	979,427
DISTRIBUTION				
Shipped by rail:				
Within district	549,424	536,347	444,867	509,610
To Northeastern district	427,193	442,815	470,075	350,174
To Southwestern district	35,000	40,000	41,092	42,195
To North Central district	20,000	25,000	26,889	27,100
Shipped by water (coastwise and river)	161			27,708
Added to stocks	500	2,820		2,603
Exported	1,308	1,095	351	20,037
	1,033,586	1,048,077	983,274	979,427

About one-half of the total supply of asphalt available in the Southeastern district was consumed within the district. Approximately seven-tenths of the domestic demand was supplied by petroleum and lake asphalt and the remaining three-tenths by natural rock asphalt mined chiefly in Kentucky. Two-thirds of the petroleum asphalt received from the Southwestern district was carried by rail across the Ohio River into Illinois, Indiana, and Ohio. About four-ninths of the rock asphalt mined in the Southeastern district was likewise shipped across the Ohio River. These combined shipments amounted to 41.3 per cent of the total supply in 1926, and 47.8 per cent in 1928, but only 35.8 per cent in 1929.

One-twelfth (8.9 per cent) of the city street surface paved in 201 representative cities of the United States was laid in the Southeastern district. In the 28 cities each with a population exceeding 40,000, which represent the Southeastern district, 3,006,718 square yards of bituminous pavement was laid in 1925, 3,302,104 square yards in 1926, and 4,181,856 square yards in 1927, but only 2,297,148 square yards in 1928 and 2,460,448 square yards in 1929. In the Southeastern district the laying of bituminous pavements roughly paralleled the general trend in city street paving. Bituminous pavements formed 63.6 per cent of the total hard-surfaced pavements laid in the Southeastern district in 1925, 58.0 per cent in 1926, 70.2 per cent in

1927, 61.8 per cent in 1928, and 67.9 per cent in 1929. The decreases in 1928 and 1929 were due chiefly to decreased paving in Florida, where the general paving decreased 59.2 per cent from 1927 to 1928 and 68.7 per cent from 1928 to 1929, and bituminous paving decreased 74.8 per cent from 1927 to 1928 and 56.3 per cent from 1928 to 1929. At the same time decreases during 1928 and 1929 in the total street pavement laid in Georgia, North Carolina, South Carolina, and Kentucky more than offset increases in Alabama, Tennessee, and Virginia.

Street pavement laid in 28 representative cities of the Southeastern district, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	1,720,065	1,308,629	2,431,319	1,134,891	1,410,150
Asphaltic concrete	783,777	1,019,797	886,503	921,782	760,610
Asphaltic macadam	41,217	31,680	16,250	69,628	41,193
Asphalt block	288,849	780,664	761,711	67,503	55,903
Natural rock asphalt	67,922	39,926	75,885	103,344	172,096
Other asphaltic types	104,888	121,408	10,188	----------	20,496
Total bituminous	3,006,718	3,302,104	4,181,856	2,297,148	2,460,448
Other pavement	1,720,389	2,394,778	1,774,216	1,417,253	1,160,972
Total pavement	4,727,107	5,696,882	5,956,072	3,714,401	3,621,420

The mileage of asphalt-surfaced rural highways, built by States, counties, and towns, in the 10 Southeastern States increased from 945 in 1925 to 1,298 in 1926, decreased to 909 in 1927 and 880 in 1928, but rose to 1,152 in 1929, according to statistics compiled and published by the Bureau of Public Roads, Department of Agriculture. This rise was due chiefly to the increased mileage of bituminous penetration macadam constructed especially in Tennessee, Virginia, and West Virginia, and to somewhat larger mileage of bituminous concrete laid in South Carolina, Tennessee, and West Virginia. Seventy per cent of the total mileage of bituminous roads built in the Southeastern district from 1925 to 1929 consisted of bituminous macadam, 17.3 per cent of bituminous concrete, 12.2 per cent of sheet asphalt, and less than 1 per cent of asphalt block. Bituminous forms of surfacing constituted 57.2 per cent of the total in 1925, but only 44.4 per cent in 1929.

Hard-surfaced rural highways built and reconstructed in the Southeastern district, 1925–1929, by types of paving, in miles [1]

Type	1925	1926	1927	1928	1929
Sheet asphalt	105	208	108	170	39
Bituminous concrete	327	208	91	129	144
Bituminous macadam	488	882	688	581	969
Asphalt block	25	----------	22	----------	----------
Total bituminous	945	1,298	909	880	1,152
Other pavement	706	1,192	1,499	1,187	1,442
Total pavement	1,651	2,490	2,408	2,067	2,594

[1] Source: Bureau of Public Roads, Department of Agriculture.

SOUTHWESTERN DISTRICT

Ninety-five per cent of the total available supply of asphalt in the Southwestern district is furnished by sources within the district itself. The proportion supplied by petroleum refineries in Texas, Louisiana, Arkansas, and Missouri decreased from 70.1 per cent of the total in 1926 to 62.6 per cent in 1929. On the other hand, the share furnished by quarries of bituminous limestone in Uvalde and Kinney Counties, Tex., as well as of bituminous sandstone in Murray County, Okla., increased from 24.9 per cent of the total in 1926 to 30.2 per cent in 1929. Receipts of asphalt in the Southwestern district from other sections of the United States are relatively unimportant.

Source and distribution of asphalt (petroleum, lake, and natural rock), exclusive of road oil, Southwestern district, 1926–1929, in short tons

	1926	1927	1928	1929
SOURCE				
Produced within district	1,245,845	1,418,382	1,178,997	1,110,826
Received by rail from:				
Pacific-Rocky Mountain district	14,000	15,000	16,716	35,306
Northeastern district	2,000	3,000	3,754	4,000
Southeastern district	35,000	40,000	41,092	42,195
Received by water (coastwise)	12,807	4,966	1,063	1,218
Withdrawn from stocks			1,500	
Imported	1,580	1,157		3,858
	1,311,232	1,482,505	1,243,122	1,197,403
DISTRIBUTION				
Shipped by rail:				
Within district	640,023	724,527	480,789	545,361
To Southeastern district	398,654	400,191	411,978	352,000
To Northeastern district	35,000	40,610	44,501	45,000
To North Central district	55,000	60,000	55,893	34,209
To Pacific-Rocky Mountain district	400	450	490	
Shipped by water (coastwise)	119,323	135,819	121,200	101,346
Added to stocks	2,500	8,700		246
Exported	60,332	112,208	128,271	119,241
	1,311,232	1,482,505	1,243,122	1,197,403

Not quite half the total available supply of asphalt in the Southwestern district is consumed within the district. About half of the total consumption of asphalt in the Southwestern district consists of petroleum asphalt, chiefly from the Gulf coast refineries, and the remaining half chiefly of Texas rock asphalt. The largest outward movement of asphalt from the Southwestern district consists of rail shipments to the Southeastern district and across the Southeastern district to the Ohio Valley States. These shipments accounted for 30.4 per cent of the total supply in 1926 and 29.4 per cent in 1929. Coastwise shipments averaged 9.4 per cent of the total from 1926 to 1928 but dropped to 8.5 per cent in 1929. Exports to foreign countries rose from 4.6 per cent of the total supply in 1926 to 10.0 in 1929. Five-sixths of these exports consisted of petroleum asphalt, practically all from refineries of the Gulf coast of Texas and Louisiana.

The area of bituminous street pavement laid in the 20 cities of over 40,000 population which represent the Southwestern district rose 20.5 per cent (from 2,901,661 square yards in 1925 to a peak of 3,497,737 square yards in 1927) but dropped 9.3 per cent to 3,173,950 square yards in 1928. In 1929, however, the total yardage of all bituminous pavements laid in the district, 2,981,378 square yards, was 6.1 per cent less than in 1928, although the total area of all street pavement laid in 1929 was 2.2 per cent greater than in the preceding year. From 1925 to 1928 the area of bituminous pavement laid in the Southwestern district kept pace with the general increases and decreases in all types of paving; the percentage of the total paving constituted by bituminous pavements fluctuated between 70 and 72 per cent. In 1929, however, the decrease in bituminous paving was greater than the general decrease in paving, and the ratio of bituminous pavement to the total dropped to 64.7 per cent.

Street pavement laid in 20 representative cities of the Southwestern district, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	491,412	479,351	304,213	459,133	182,575
Asphaltic concrete	1,661,126	1,932,728	2,067,804	1,738,035	1,588,957
Asphaltic macadam					151,192
Natural rock asphalt	696,594	645,409	1,008,694	884,979	905,120
Other asphaltic types	52,529	41,457	117,026	91,803	153,534
Total bituminous	2,901,661	3,098,945	3,497,737	3,173,950	2,981,378
Other pavement	1,134,560	1,328,755	1,444,975	1,335,627	1,628,360
Total pavement	4,036,221	4,427,700	4,942,712	4,509,577	4,609,738

The total mileage of new and reconditioned rural highways surfaced with bituminous compounds built in Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas decreased from 416 miles in 1925 to 312 miles in 1926 and increased to 472 miles in 1927 and 982 miles in 1928, but fell off to 227 miles in 1929. The sharp rise in 1928 and the abrupt drop in 1929 were due chiefly to the extensive use of asphaltic penetration macadam in Texas in 1928. Consequently, the percentage of the total hard-surfaced mileage built of bituminous compounds rose from 27.5 per cent in 1925 to 52.7 per cent in 1928, but dropped to 13.9 per cent in 1929.

Hard-surfaced rural highways built and reconstructed in the Southwestern district, 1925–1929, by types of paving, in miles [1]

Type	1925	1926	1927	1928	1929
Sheet asphalt		21	21		4
Bituminous concrete	47	36	201	90	148
Bituminous macadam	369	255	250	892	75
Total bituminous	416	312	472	982	227
Other pavement	1,098	790	510	880	1,401
Total pavement	1,514	1,102	982	1,862	1,628

[1] Source: Bureau of Public Roads, Department of Agriculture.

NORTH CENTRAL DISTRICT

Nearly two-thirds (64.4 per cent) of the asphalt available for distribution in the North Central district in 1929 was received by rail from the Northeastern and nearly one-sixth (16.2 per cent) by rail from the Southwestern district. Receipts by rail from the Southeastern district constituted 12.8 per cent of the whole and rail receipts from the Pacific-Rocky Mountain district the remaining 6.6 per cent.

Fully 99 per cent of the asphalt available for distribution in the North Central district was consumed within the district. Exports of asphalt by rail across the border to Canada were relatively insignificant.

Source and distribution of asphalt (petroleum, lake, and natural rock), exclusive of road oil, North Central district, 1926–1929, in short tons

	1926	1927	1928	1929
SOURCE				
Received by rail from:				
Northeastern district	107,386	126,339	131,384	136,234
Southeastern district	20,000	25,000	26,889	27,100
Southwestern district	55,000	60,000	55,893	34,209
Pacific-Rocky Mountain district	45,000	50,000	51,415	14,009
	227,386	261,339	265,581	211,552
DISTRIBUTION				
Shipped by rail within district	226,792	258,260	264,014	209,491
Exported	594	3,079	1,567	2,061
	227,386	261,339	265,581	211,552

In the 18 cities which represent the North Central district the laying of bituminous street pavement decreased considerably from 1925 to 1929 both in yardage and in relative importance. In yardage it decreased 50.8 per cent (from 1,818,340 square yards in 1925 to 894,121 square yards in 1929). In their ratio to the total pavement laid, bituminous pavements declined from 47.2 per cent in 1925 to 32.4 per cent in 1929. Nearly half (48.8 per cent) of the bituminous pavement consisted of asphaltic concrete, 37.7 per cent of sheet asphalt, and 13.5 per cent of asphaltic macadam. The chief decrease occurred in asphaltic concrete, of which the yardage laid in 1929 was only 34.2 per cent of that laid in 1925. Sheet asphalt fell off 31.5 per cent during the same period and asphaltic macadam 31.6 per cent.

Street pavement laid in 18 representative cities of the North Central district, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	639,058	585,026	374,612	439,726	437,831
Asphaltic concrete	1,030,836	695,946	720,729	401,633	352,941
Asphaltic macadam	148,446	209,052	240,092	185,589	101,566
Other asphaltic types					1,783
Total bituminous	1,818,340	1,490,024	1,335,433	1,026,948	894,121
Other pavement	2,035,518	1,981,005	2,239,235	1,765,578	1,861,509
Total pavement	3,853,858	3,471,029	3,574,668	2,792,526	2,755,630

The total length of new and reconstructed rural highways surfaced with bituminous compounds built in Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin rose from 7 miles in 1925 to 39 miles in 1926, dropped to 10 miles in 1927, but rose to 14 miles in 1928 and 34 miles in 1929. Altogether the bituminous-surfaced highways formed only 2.4 per cent of the total hard-surfaced highways built and reconstructed from 1925 to 1929, inclusive.

Hard-surfaced rural highways built and reconstructed in the North Central district, 1925–1929, by types of paving, in miles[1]

Type	1925	1926	1927	1928	1929
Sheet asphalt	--------	28	--------	--------	--------
Bituminous concrete	2	7	5	7	1
Bituminous macadam	5	4	5	7	33
Total bituminous	7	39	10	14	34
Other pavement	316	565	866	1,096	1,307
Total pavement	323	604	876	1,110	1,341

[1] Source: Bureau of Public Roads, Department of Agriculture.

PACIFIC-ROCKY MOUNTAIN DISTRICT

Eighty-nine per cent of the total available supply of bituminous materials in the Pacific coast district from 1926 to 1929 consisted of petroleum asphalt made in refineries near San Francisco and Los Angeles, and near Casper, Wyo. About 7.0 per cent consisted of gilsonite, wurtzilite, and ozokerite mined in the Uinta Basin in northeastern Utah. Rock asphalt quarried in California and in Utah made up only an insignificant fraction of the total supply during the four years ended December 31, 1929.

Although the actual tonnage of asphalt consumed within the Pacific-Rocky Mountain district varied little from year to year, domestic consumption decreased in relative importance. It accounted for 66.9 per cent of the total available supply in 1926, but only 47.1 per cent in 1929. On the other hand, exports, chiefly to Australia, New Zealand, and eastern Asia, grew both in quantity and in relative importance. They constituted 11.9 per cent of the total available supply in 1926, and 29.2 per cent in 1929. Similarly, coastwise shipments grew in comparative importance, from 8.0 per cent of the total in 1926 to 14.0 per cent in 1929. Because of the difficulties imposed by mountains, deserts, and distance from the thickly populated centers of the Middle West and the East, comparatively little of the asphalt made in the California refineries is shipped by rail to other sections of the United States.

Source and distribution of asphalt (petroleum, lake, and native), exclusive of road oil, Pacific-Rocky Mountain district, 1926–1929, in short tons

	1926	1927	1928	1929
SOURCE				
Produced within district	578,148	606,174	688,868	737,507
Received by rail from Southwestern district	400	450	490	--------
Received by water (coastwise)	15,484	13,237	13,000	32,076
Withdrawn from stocks	--------	--------	8,800	10,487
Imported	9	10	13	259
	594,041	619,871	711,171	780,329
DISTRIBUTION				
Shipped by rail:				
Within district	226,802	242,579	232,332	206,136
To North Central district	45,000	50,000	51,415	14,009
To Southwestern district	14,000	15,000	16,716	35,306
To Northeastern district	2,000	2,500	2,928	26,300
Shipped by water (coastwise)	47,532	58,258	63,063	109,385
Shipped by electric railroads, minor steam railroads, and motor trucks, and intraport	170,294	139,857	176,288	161,298
Added to stocks	17,900	10,600	--------	--------
Exported	70,513	101,077	168,429	227,895
	594,041	619,871	711,171	780,329

The total yardage of bituminous pavement laid in the 22 cities of over 40,000 population which represent the Pacific-Rocky Mountain district increased 35.7 per cent (from 5,194,857 square yards in 1925 to 7,051,007 square yards in 1926) but dropped 32.2 per cent to 4,782,428 square yards in 1927, increasing 11.0 per cent to 5,309,139 square yards in 1928, and remaining practically level at 5,333,965 square yards in 1929. The ratio of bituminous pavements to the entire area of street pavement decreased from 65.3 per cent in 1925 to 41.6 per cent in 1928, but rose to 50.4 per cent in 1929. Sixty-five per cent of all bituminous substances laid in the Pacific-Rocky Mountain district consisted of asphaltic concrete of various types. Sheet asphalt formed only 26.4 per cent of the whole, and miscellaneous bituminous types only 8.9 per cent.

Street pavement laid in 22 representative cities of the Pacific-Rocky Mountain district, 1925–1929, by types of paving, in square yards

Type	1925	1926	1927	1928	1929
Sheet asphalt	1,290,833	1,375,977	1,496,066	1,287,432	1,854,291
Asphaltic concrete	3,138,667	5,276,585	2,705,159	3,716,472	3,065,908
Asphaltic macadam	----------	----------	----------	----------	587
Other asphaltic types	765,357	398,445	581,203	305,235	413,179
Total bituminous	5,194,857	7,051,007	4,782,428	5,309,139	5,333,965
Other pavement	2 763,285	4,152,100	6,309,151	7,457,676	5,258,494
Total pavement	7,958,142	11,203,107	11,091,579	12,766,815	10,592,459

In Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, and Washington, which correspond roughly to the Pacific-Rocky Mountain district, the mileage of rural highways surfaced with bituminous compounds increased from 265 in 1925 to 405 in 1926, dropped to 384 in 1927, rose to 658 in 1928, and decreased to 592 in 1929, according to figures compiled and published by the Bureau of Public Roads, Department of Agriculture. Nearly three-fourths of the total mileage of bituminous roads was laid in California and one-eighth in Oregon. The share of bituminous surfacing in the total new and reconstructed mileage of hard-surfaced pavements increased from 39.7 per cent of the total mileage constructed in 1925 to 73.6 per cent in 1929.

Hard-surfaced rural highways built and reconstructed in Pacific-Rocky Mountain district, 1925–1929, by types of paving, in miles[1]

Type	1925	1926	1927	1928	1929
Sheet asphalt	----------	11	45	57	56
Bituminous concrete	193	227	117	170	59
Bituminous macadam	72	167	222	431	477
Total bituminous	265	405	384	658	592
Other pavement	403	211	345	339	212
Total pavement	668	616	729	997	804

[1] Source: Bureau of Public Roads, Department of Agriculture.

IMPORTS AND EXPORTS

IMPORTS

Imports of asphalt into the United States increased 1.2 per cent in quantity (from 119,588 short tons in 1928 to 121,019 tons in 1929) and 10.5 per cent in value (from $865,046 in 1928 to $955,606 in 1929). As in 1927 and 1928 Trinidad, Venezuela, and Cuba supplied almost the entire amount. The famous Pitch Lake, near Brighton, Trinidad, was the chief source of supply; it furnished 85,038 short tons or 53.8 per cent of the total imports of asphalt into the United States in 1927; 51,599 tons or 43.1 per cent of the total imports in 1928; and 69,909 tons or 57.8 per cent of the total in 1929. From the well-known Bermudez Lake of Venezuela, near Guanoco, came 66,254 short tons or 41.9 per cent of the total imports of asphalt into the United States in 1927; 53,046 tons or 44.4 per cent of the total imports in 1928; and 36,605 tons or 30.2 per cent of the total in 1929. The mines of grahamite near Talaren, Province of Camaguey, Cuba, shipped 2,616 short tons or 1.7 per cent of the total in 1927; 12,629 tons or 10.6 per cent of the total imports in 1928; and 12,854 tons or 10.6 per cent of the total imports in 1929.

Native asphalt and bituminous rock imported into the United States, 1925–1929, by countries

[General imports]

Country	1925		1926		1927		1928		1929	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
North America:										
Bermuda	4	$428	------	------	------	------	------	------	------	------
Canada	9	920	167	$2,211	19	$673	614	$11,261	374	$6,921
Mexico	(1)	25	1,668	24,390	------	------	52	1,105	------	------
West Indies:										
British—										
Barbados	76	5,123	190	7,861	21	2,292	22	2,752	44	4,340
Jamaica	836	8,360	------	------	------	------	------	------	------	------
Trinidad and Tobago	76,820	526,999	76,562	562,888	85,038	626,566	51,599	364,656	69,909	558,914
Other	58	1,336	------	------	2,319	17,419	------	------	------	------
Cuba	2,323	60,535	11,886	94,087	2,616	27,714	12,629	109,448	12,854	113,438
South America:										
Argentina	11	182	12	86	53	1,111	------	------	------	------
Colombia	22	1,473	------	------	------	------	------	------	------	------
Ecuador	------	------	4,637	30,636	------	------	------	------	------	------
Venezuela	37,160	246,558	46,292	305,854	66,254	437,744	53,046	350,478	36,605	253,544
Europe:										
Azores and Madeira Islands	------	------	------	------	(1)	5	------	------	------	------
Belgium	------	------	------	------	7	63	1	80	3	139
Czechoslovakia	------	------	------	------	1	25	------	------	------	------
Denmark	------	------	49	800	3	126	2	78	1	44
France	------	------	3	78	2	140	9	388	23	988
Germany	1,465	19,817	1,126	15,167	1,619	20,613	1,467	16,481	1,136	12,814
Italy	------	------	------	------	------	------	1	26	8	95
Netherlands	1	12	(1)	10	2	310	13	638	2	427
Poland and Danzig	------	------	------	------	4	100	2	25	------	------
Switzerland	3	185	2	483	58	495	2	499	1	246
United Kingdom	3,367	34,633	10	545	81	5,029	17	1,481	35	2,315
Yugoslavia and Albania	------	------	28	500	------	------	------	------	------	------
Asia: Palestine and Syria	7	838	------	------	------	------	------	------	------	------
Africa: Egypt	------	------	------	------	------	------	112	5,650	24	1,381
	122,162	907,424	142,632	1,045,596	158,097	1,140,425	119,588	865,046	121,019	955,606

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[1] Figures for quantity not available.

EXPORTS

Exports of petroleum asphalt decreased 2.6 per cent in quantity (from 492,362 short tons in 1928 to 479,404 tons in 1929) and 12.7 per cent in value (from $9,788,501 in 1928 to $8,542,975 in 1929). Shipments to northern and western Europe fell off one-third (from 264,476 short tons in 1928 to 176,034 tons in 1929). Exports to Germany dropped 58.9 per cent (from 103,550 short tons in 1928 to 42,547 tons in 1929), to the Netherlands 66.1 per cent (from 55,540 tons in 1928 to 18,845 tons in 1929), to Denmark 60.3 per cent (from 16,744 tons in 1928 to 6,647 tons in 1929), and to the United Kingdom 5.5 per cent (from 35,736 tons in 1928 to 33,781 tons in 1929).

On the other hand, these decreases were in part offset by substantial increases in the exports of petroleum asphalt to eastern Asia and Oceania, to the Caribbean countries, and to the Mediterranean region. The largest gains, both relative and absolute, took place in the Far East. Exports to Australia increased 64.8 per cent (from 33,391 short tons in 1928 to 55,028 tons in 1929), to the Netherland East Indies 35.5 per cent (from 23,543 tons in 1928 to 31,892 tons in 1929), to British Malaya 93.4 per cent (from 4,719 tons in 1928 to 9,128 tons in 1929), to the Philippine Islands 69.8 per cent (from 4,730 tons in 1928 to 8,030 tons in 1929), and to French Indo-China 30.1 per cent (from 5,997 tons in 1928 to 7,805 tons in 1929). The gain of 21,535 short tons in shipments to the Caribbean region was due chiefly to greater exports to Cuba. These jumped from 105 short tons in 1928 to 19,609 tons in 1929. In the Mediterranean region exports to Italy increased from 11,686 short tons in 1928 to 15,305 tons in 1929, and to Turkey from 22 tons in 1928 to 3,423 tons in 1929. The small gain in exports to the Indian Ocean region was due chiefly to shipments of 7,766 short tons to Ceylon in 1929, as compared to 6,003 tons in 1928.

Asphalt exported from the United States in 1929, by countries

Country	Native asphalt and bitumen				Petroleum asphalt	
	Unmanufactured		Manufactures of, except roofing		Short tons	Value
	Short tons	Value	Short tons	Value		
North America:						
Bermuda	----------	----------	18	$407	30	$620
Canada	5,293	$117,234	6,604	243,421	47,719	634,544
Central America—						
Costa Rica	----------	----------	----------	----------	4	114
Guatemala	----------	----------	32	1,788	726	11,895
Honduras	----------	----------	6	329	29	663
Nicaragua	1	52	----------	----------	601	12,627
Panama	28	510	116	5,185	521	22,597
Salvador	6	161	1	30	493	9,623
Mexico	125	1,604	171	7,983	824	13,877
Newfoundland and Labrador	7	175	4	374	2	89
West Indies—						
British—						
Barbados	----------	----------	11	3,250	----------	----------
Jamaica	----------	----------	792	35,152	1	31
Trinidad and Tobago	----------	----------	4	169	----------	----------
Other	99	2,164	419	12,840	307	12,511

Asphalt exported from the United States in 1929, by countries—Continued

Country	Native asphalt and bitumen				Petroleum asphalt	
	Unmanufactured		Manufactures of, except roofing		Short tons	Value
	Short tons	Value	Short tons	Value		
North America—Continued.						
West Indies—Continued.						
Cuba	703	$14,778	232	$8,423	19,609	$419,989
Dominican Republic	52	707	12	1,937	111	2,575
French	----------	----------	[1]	21	1	23
Haiti	----------	----------	135	4,690	276	6,856
Netherland	----------	----------	7	1,423	2	43
Virgin Islands of the United States	----------	----------	[1]	15	56	1,369
South America:						
Argentina	367	7,807	671	40,096	5,365	112,996
Bolivia	----------	----------	5	1,102	----------	----------
Brazil	2,517	49,215	2,005	100,502	11,291	226,198
Chile	11	278	244	8,477	2,496	44,701
Colombia	296	5,747	1,271	57,816	1,257	25,918
Ecuador	7	150	104	3,371	76	2,118
Guiana—						
British	----------	----------	2	77	28	425
French	----------	----------	18	612	----------	----------
Paraguay	----------	----------	21	5,151	----------	----------
Peru	13	235	38	3,743	782	13,681
Uruguay	244	4,306	634	19,936	233	5,909
Venezuela	1	30	1,444	82,623	35	1,001
Europe:						
Austria	----------	----------	----------	----------	1,663	26,999
Azores and Madeira Islands	----------	----------	----------	----------	62	1,140
Belgium	454	10,208	258	7,935	5,944	101,223
Czechoslovakia	45	753	----------	----------	----------	----------
Denmark	6	305	10	2,327	6,647	142,799
Finland	4	181	187	5,006	----------	----------
France	2,894	106,238	394	17,317	35,661	651,977
Germany	5,756	189,851	2,611	76,190	42,547	787,861
Greece	----------	----------	----------	----------	469	10,160
Irish Free State	4,628	82,640	----------	----------	337	6,635
Italy	14,181	307,193	1,156	26,993	15,305	279,086
Latvia	16	339	----------	----------	----------	----------
Netherlands	418	14,145	356	8,472	18,845	340,218
Norway	2	57	39	2,106	860	17,498
Poland and Danzig	----------	----------	480	10,100	11	233
Portugal	21	460	----------	----------	----------	----------
Rumania	----------	----------	----------	----------	17	350
Spain	533	11,184	3,423	99,313	29,156	469,725
Sweden	165	4,891	149	6,174	1,153	24,448
United Kingdom	6,274	142,373	1,797	92,734	33,781	783,829
Asia:						
Ceylon	----------	----------	13	504	7,766	140,094
China	20	1,000	356	24,266	12,280	229,187
East Indies—						
British—						
India	8	303	1,579	84,882	9,233	178,560
Malaya	10	125	548	21,765	9,128	139,381
Netherland—						
Java and Madura	24	466	2	83	27,845	434,981
Other	----------	----------	7	710	4,047	59,736
Hong Kong	----------	----------	----------	----------	4,189	67,209
Indo-China (French)	----------	----------	----------	----------	7,805	119,347
Japan, including Chosen	274	12,699	853	61,523	17,196	367,758
Kwangtung	----------	----------	----------	----------	1,271	23,822
Philippine Islands	81	1,218	29	1,298	8,030	118,317
Siam	----------	----------	----------	----------	2,638	51,914
Syria	----------	----------	5	1,159	----------	----------
Turkey in Asia	----------	----------	----------	----------	3,423	47,881
Other	----------	----------	18	420	----------	----------
Africa:						
British—						
East	----------	----------	1	206	1,516	36,654
South (Union of)	----------	----------	268	17,040	3,815	94,475
West ("Other")	----------	----------	----------	----------	444	9,880
Other	----------	----------	2	244	2,965	69,550
Canary Islands	16	300	10	205	1	45
Egypt	12	306	28	974	----------	----------
French—						
Algeria and Tunisia	----------	----------	----------	----------	2,908	48,875
Other	----------	----------	----------	----------	1,122	25,355

[1] Less than 1 ton.

Asphalt exported from the United States in 1929, by countries—Continued

Country	Native asphalt and bitumen				Petroleum asphalt	
	Unmanufactured		Manufactures of, except roofing			
	Short tons	Value	Short tons	Value	Short tons	Value
Africa—Continued.						
Liberia			(1)	$29		
Morocco			1	222	319	$7,602
Portuguese—						
Mozambique			7	1,645	1,557	38,115
Other					22	675
Oceania:						
British—						
Australia	1,333	$40,045	797	37,101	55,028	842,870
New Zealand	17	625	805	20,182	9,317	160,111
Other					181	3,267
French					25	740
	46,962	1,133,058	31,210	1,280,068	479,404	8,542,975

[1] Less than 1 ton.

Asphalt and related bitumens exported from the United States, 1920–1929

Year	Native asphalt				Petroleum asphalt		Total value
	Unmanufactured		Manufactures of	Total	Short tons	Value	
	Short tons	Value					
1920	51,706	$1,356,116	$842,074	$2,198,190	(1)	(1)	(1)
1921	45,367	1,178,038	621,224	1,799,262			
1922	57,362	1,344,440	[2] 1,261,125	2,605,565			
1923	72,628	1,500,869	[2] 2,075,628	3,576,497			
1924	52,568	1,245,670	[2] 2,212,260	3,457,930			
1925	32,835	825,654	[2] 2,525,618	3,351,272	89,014	$1,762,048	$5,113,320
1926	38,218	905,743	[2] 2,189,808	3,095,551	146,589	3,183,746	6,279,297
1927	39,875	1,034,334	[2] 2,399,700	3,434,034	385,031	8,325,413	11,759,447
1928	26,263	683,563	[2] 2,022,251	2,705,814	492,362	9,788,501	12,494,315
1929	46,962	1,133,058	[2] 2,382,260	3,515,318	479,404	8,542,975	12,058,293

[1] Exports of petroleum asphalt not separately classified prior to 1925.

[2] Inclusive of value of squares (10 by 10 feet) of roofing asphalt as follows: 1922, 588,636 squares, $870,200; 1923, 783,028 squares, $1,124,491; 1924, 697,293 squares, $998,469; 1925, 661,662 squares, $919,977; 1926, 938,176 squares, $1,212,409; 1927, 853,842 squares, $1,150,722; 1928, 934,908 squares, $1,251,429; 1929, 829,066 squares, $1,102,192. Corresponding exports not separately shown prior to 1922.

WORLD PRODUCTION

The United States is the largest producer of natural rock asphalt in the world. Its production averages about twice that of Italy, its nearest competitor, and more than six times that of Germany, which occupies third place.

On the other hand, Trinidad, with its famous Pitch Lake near Brighton, leads the world in the production of native asphalts of a high degree of purity. It is followed by Venezuela, whose Bermudez Lake, near Guanoco, State of Sucre, is almost equally well known. The United States owes its position in the third rank to the production of gilsonite, wurtzilite, and ozokerite in Utah.

No sufficiently complete statistics of the production of petroleum asphalt by the countries leading in oil refining are available. Nevertheless, such data as are at hand indicate that the United States leads all other countries in this industry.

Asphalt rock, natural asphalt, and related bitumens produced in the principal producing countries, 1925–1929, in metric tons [1]

[Compiled under supervision of L. M. Jones, of the Bureau of Mines]

Country and mineral [2]	1925	1926	1927	1928	1929
ASPHALT ROCK					
Albania	3, 164	3, 860	3, 283	2, 277	2, 512
Canada (Alberta) [3]	1, 041	479	2, 455	85	897
France	52, 446	58, 240	48, 530	54, 710	45, 600
Germany	64, 115	60, 966	117, 836	158, 329	(4)
Greece	5, 256	402	290	3, 173	1, 196
Italy	272, 990	312, 790	356, 154	242, 300	219, 584
Netherland East Indies	670	155	1, 340	3, 660	15, 030
Rumania	15, 709	24, 891	30, 712	8, 875	--------
Russia [5]	11, 288	30, 606	48, 378	48, 620	(4)
Spain	5, 580	5, 856	4, 514	7, 735	9, 002
United States	494, 468	610, 305	722. 206	689, 908	679, 070
Yugoslavia	286	85	142	535	61
NATURAL ASPHALT AND RELATED BITUMENS					
Barbados [6]	30	109	46	60	51
Cuba	2, 814	7, 988	4, 116	13, 186	10, 695
France	16	27	(4)	(4)	(4)
Italy	678	735	791	2, 178	919
Peru	1, 068	690	892	981	950
Poland [7]	738	723	736	767	835
Rumania [7]	3	--------	--------	--------	--------
Russia [5] [7]	392	955	843	710	(4)
Switzerland [8]	35, 757	28, 200	36, 716	21, 321	20, 009
Trinidad	204, 335	241, 109	246, 017	199, 125	223, 128
United States	36, 097	38, 492	38, 954	42, 967	50. 328
Venezuela	33, 679	51, 552	56, 906	48, 749	54, 332

[1] Minerals included are asphalt rock, bituminous rock used for other purposes than the extraction of oil, native asphalt, asphaltite, manjak, and ozokerite. Oil shales, including ichthyolic shale, are not included.

[2] In addition to those listed, the following countries are reported to produce asphalt and related bitumens, but figures of annual output are not available: Colombia (reported to have produced 358 tons in 1925), Iraq, Madagascar, and Syria.

[3] Bituminous sands.

[4] Data not available.

[5] Year ended September 30.

[6] Exports of manjak.

[7] Ozokerite.

[8] Exports.

ROAD OIL

Road oil is a residual oil from the distillation of petroleum, applied directly to the surface of a road, highway, or street to lay the dust and bind the loose particles of rock together. Untreated crude oil, especially of the heavy asphaltic type, has also been used as a surface dressing for roads.

The production of road oil by petroleum refineries in the United States increased 29.0 per cent in quantity (from 617,742 [7] short tons or about 3,670,000 barrels in 1928 to 797,099 tons or 4,750,000 barrels in 1929). Of the national totals, California furnishd 223,274 short tons or 36.1 per cent in 1928 and 313,490 tons or 39.3 per cent in in 1929. The Indiana-Illinois district was second, providing 200,163 short tons or 32.4 per cent of the total in 1928 and 211,750 tons or 26.6 per cent in 1929. Refineries of the East coast furnished 103,391 tons or 16.7 per cent of the whole in 1928 and 113,768 tons or 14.3 per cent in 1929. Gulf coast refineries in Texas and Louisiana produced 49,882 tons or 8.1 per cent of the whole in 1928 and 77,985 tons or 9.8 per cent in 1929.

Less road oil was made from foreign crude in 1929 than in 1928. From 126,013 short tons in 1928 the amount distilled from foreign crude fell off to 116,126 tons in 1929. From 20.4 per cent in 1928 its share in the total production of road oil decreased to 14.6 per cent in 1929. Sixty-one per cent (77,056 tons) of the road oil made from foreign crude was made in East coast refineries in 1928 and 75.4 per cent (87,563 tons) in 1929.

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[7] The 850,000 short tons or 4,964,000 barrels, given in Asphalt and Related Bitumens in 1928, p. 408, as the production of road oil in the United States in 1928, includes considerable quantities of cut-back asphalts and liquid fluxes, which in this chapter are classed as asphalts.

Production, stocks, and sales of road oil at refineries in the United States, 1928 and 1929, by districts

District	Production (short tons)	Stocks (short tons)		Sales	
		Jan. 1	Dec. 31	Short tons	Value
1928					
East coast	103,391	3,453	5,150	101,694	$1,172,609
Appalachian	1,343	510	141	1,712	25,025
Indiana-Illinois	200,163	51,468	14,708	236,923	1,887,330
Oklahoma-Kansas	32,243	5,373	2,035	35,581	293,862
Texas[1]	514			514	4,250
Louisiana-Arkansas: Gulf coast	49,882		9	49,873	594,376
Rocky Mountain	6,932	988	189	7,731	61,016
California	223,274	4,948	5,140	223,082	1,810,164
Grand total	617,742	66,740	27,372	657,110	5,848,632
1929					
East coast	113,768	5,150	4,149	114,769	1,731,744
Appalachian	773	141		914	12,016
Indiana-Illinois	211,750	14,708	7,115	219,343	1,486,564
Oklahoma-Kansas	49,152	2,035	444	50,743	303,530
Texas:					
Gulf coast	63,255			63,255	948,816
Rest of State	11			11	49
Total Texas	63,266			63,266	948,865
Louisiana-Arkansas: Gulf coast	14,719	9		14,728	135,515
Rocky Mountain	30,181	189	1,384	28,986	251,214
California	313,490	5,140	11,550	307,080	2,434,773
Grand total	797,099	27,372	24,642	799,829	7,304,221

[1] None produced in Texas Gulf coast district.

Stocks of road oil fell off 59.0 per cent (from 66,740 short tons on December 31, 1927, to 27,372 tons on December 31, 1928) and decreased 10.0 per cent (to 24,642 tons on December 31, 1929). Owing to differences in the method of classifying liquid asphaltic oils, statistics of stocks of road oil as reported by the producing companies are not altogether satisfactory, and recourse has been had in part to estimates. Many companies report only sales of road oil and keep no records of stocks of road oil as such. Certain heavy asphaltic residual oils may be equally well burned as fuel oil or spread on the highway as road oil. Accordingly, the designation under which these oils are reported depends on the use to which the purchaser intends to put them. Nevertheless, it is believed that the statistics of road-oil stocks indicate fairly accurately the existing trends in 1928 and 1929.

The quantity of road oil sold in the United States amounted to 657,110 short tons in 1928 and to 799,829 tons in 1929, an increase of 21.7 per cent. The principal increase occurred in California, where 223,082 short tons was sold in 1928 and 307,080 tons in 1929. In the East coast district sales of road oil increased from 101,694 tons in 1928 to 114,769 tons in 1929 and in the Gulf coast district from 49,873 tons in 1928 to 77,983 tons in 1929. On the other hand, sales in the Indiana-Illinois district decreased from 236,923 tons in 1928 to 219,343 tons in 1929.

Sales of road oil increased 24.9 per cent in value (from $5,848,632 in 1928 to $7,304,221 in 1929). The average sales value for the United States was $8.90 per short ton or about $1.50 per barrel of 42 gallons in 1928 and $9.13 per ton or $1.53 per barrel in 1929. In the East coast district the average sales value increased from $11.53 per short ton or about $1.94 per barrel in 1928 to $15.09 per ton or $2.54 per barrel in 1929. A similar increase occurred in the Gulf coast district (from $11.92 per ton or about $2.00 per barrel in 1928 to $13.90 per ton or $2.34 per barrel in 1929). On the other hand, in the Indiana-Illinois district the average sales value decreased from $7.97 per short ton or $1.34 per barrel in 1928 to $6.78 per ton or $1.14 per barrel in 1929. In California the average sales value decreased from $8.11 per ton or about $1.36 per barrel in 1928 to $7.93 per ton or $1.33 per barrel in 1929.

PRODUCERS OF ASPHALTIC MATERIAL FROM CRUDE PETROLEUM

The following operators reported the production of asphaltic material from crude petroleum in the United States in 1929:

Atlantic Refining Co., 260 South Broad Street, Philadelphia, Pa.
Barber Asphalt Co., 1600 Arch Street, Philadelphia, Pa.
Beacon Oil Co., 285 Columbus Avenue, Boston, Mass.
James B. Berry's Sons Co., 310 South Michigan Avenue, Chicago, Ill.
Canfield Oil Co., 3216-20 East Fifty-fifth Street, Cleveland, Ohio.
Cities Service Refining Co., 260 Tremont Street, Boston, Mass.
Gilmore Oil Co. (Ltd.), 2423 East Twenty-eighth Street, Los Angeles, Calif.
Houston Oil Terminal Co., 1019 Post Dispatch Building, Houston, Tex.
Humble Oil & Refining Co., Houston, Tex.
Indian Refining Co., Lawrenceville, Ill.
Lincoln Oil Refining Co., Robinson, Ill.
Louisiana Oil & Refining Corporation, Shreveport, La.
Magnolia Petroleum Co., Box 1667, Dallas, Tex.
Mexican Petroleum Corporation, 122 East Forty-second Street, New York, N.Y.
Mexican Petroleum Corporation of Louisiana (Inc.), 122 East Forty-second Street, New York, N.Y.
Mid-Continent Petroleum Corporation, Cosden Building, Tulsa, Okla.
Midwest Refining Co., First National Bank, Denver, Colo.
New England Oil Refining Co., Fall River, Mass.
Orange County Refining Co., 317½ East Second Street, Los Angeles, Calif.
Pan American Petroleum Co., 1034 Petroleum Securities Building, Los Angeles, Calif.
Paraffine Cos. (Inc.), 475 Brannan Street, San Francisco, Calif.
Pioneer Paper Co., 120 Arcade Station, Los Angeles, Calif.
Richfield Oil Co. of California, 555 South Flower Street, Los Angeles, Calif.
Seaside Oil Co., Summerland, Calif.
Shell Oil Co., 200 Bush Street, San Francisco, Calif.
Shell Petroleum Corporation, Shell Building, St. Louis, Mo.
Sinclair Refining Co. of Louisiana (Inc.), 321 Hibernia Bank Building, New Orleans, La.
Standard Oil Co. of California, 225 Bush Street, San Francisco, Calif.
Standard Oil Co. (Indiana), 910 South Michigan Avenue, Chicago, Ill.
Standard Oil Co. of Kansas, Neodesha, Kans.
Standard Oil Co. of Louisiana, Baton Rouge, La.
Standard Oil Co. of New Jersey, 26 Broadway, New York, N.Y.
Standard Oil Co. of New York, 26 Broadway, New York, N.Y.
Standard Oil Co. of Ohio, East Ohio Gas Building, Cleveland, Ohio.
Sun Oil Co., 1608 Walnut Street, Philadelphia, Pa.
The Texas Co., Houston, Tex.
The Tidewater Oil Co., 11 Broadway, New York, N.Y.
Union Oil Co. of California, Union Oil Building, Los Angeles, Calif.
Utah Oil Refining Co., Post Office Box 1782, Salt Lake City, Utah.
Warner-Quinlan Co., 2 Park Avenue, New York, N.Y.

ASPHALT ASSOCIATIONS

On January 1, 1930, The Asphalt Association, 441 Lexington Avenue, New York City, was reorganized as The Asphalt Institute. The objects of the institute are to conduct research on all uses of asphalt and asphaltic oils, to disseminate scientific, technical, and economic information on asphalt and asphaltic oils, to promote the use of asphalt, to eliminate objectionable and unsound trade practices, to build up a practicable code of ethics, and to cooperate with Government agencies in establishing standard grades and eliminating unnecessary grades of asphalt. The Asphalt Institute is now at 801 Second Avenue, New York City. The president is Leroy M. Law, Shell Petroleum Corporation; secretary, B. L. Boye, Standard Oil Co. of New York; treasurer, Fisher Jones, Mexican Petroleum Corporation; managing director, J. E. Pennybacker.

The American Association of Asphalt Technologists, of New York, consists of technical experts serving States, cities, and counties, as well as those engaged in the industry. The president is Prevost Hubbard, chemical engineer, of The Asphalt Institute, and the secretary, Charles L. Mullen, of the Milton Hersey Co., Montreal, Quebec.

The Asphalt Paving Association, Engineering Building, Chicago, was formed in May, 1929, as an organization of hot-mix paving contractors operating chiefly in central United States. The president is Frank O. Hodson, of Gary, Ind., and the secretary, Frank J. Silsbee, of Chicago.

The Western Asphalt Association, composed of the leading producers of asphalt on the Pacific coast and of large contractors who build asphalt roads, was formed during the latter part of 1926. Its purpose is to educate the public as to the merits of asphaltic-type roads. The headquarters of this association are at 650 South Grant Avenue, Los Angeles, Calif.

ACKNOWLEDGMENTS

The cooperation of the Interstate Commerce Commission; of the Bureau of Public Roads, Department of Agriculture; of the Bureau of the Census and the Bureau of Foreign and Domestic Commerce, Department of Commerce; of the Board of Engineers for Rivers and Harbors, United States Army; and of the Bureau of Research, United States Shipping Board, in furnishing or making accessible information in their files, is gratefully acknowledged.

COKE AND BY-PRODUCTS[1]

By F. G. Tryon and H. L. Bennit

REVIEW OF INDUSTRY IN 1929

Viewed as a whole, 1929 was a year of expansion and great activity during which the coke industry shared the almost riotous prosperity of American business. The boom was abruptly terminated by the stock-market collapse of October 28, which began a period of depression that was to overshadow the market throughout the following year. The quiet of the last two months of 1929, however, was not sufficient to offset the activity of the first ten, and the year as a whole set new records in the production of iron and steel and in the consumption of coke for household fuel.

Responding to these influences the production of coke reached the record total of 59,884,000 tons in 1929, exceeding by 2,907,000 tons the previous maximum established in 1923. In comparison with 1928 the year showed an increase of over 13 per cent. Even the beehive branch of the industry shared the increase, as production from beehive ovens increased from 4,493,000 tons in 1928 to 6,472,000 in 1929. In the same period production from by-product ovens increased from 48,313,000 to 53,412,000 tons. The dominance of the by-product ovens was again demonstrated, for even during a year of peak activity in the steel industry they contributed 89.2 per cent of the total supply.

Exports of coke were the largest for any year since the war, and consumption within the United States set a new high record. (See Table 38.) Consumption in blast furnaces, it is true, did not equal that of some earlier years, because of notable advances in fuel economy (Table 39 and fig. 23), but consumption for domestic purposes far exceeded all previous records. The sales of by-product coke for domestic use have increased from about 1,408,000 tons in 1918 to 7,376,000 tons in 1929. (See fig. 25.) The experience of 1929 again demonstrates that further expansion of the market for coke depends largely on the demand for household fuel.

The peak of the year's activity was reached in June. (See fig. 18.) The brisk demand permitted partial liquidation of stocks, and by the end of the winter of 1928–29 the tonnage of unsold coke on hand at merchant plants was much lower than at any time during 1928. (See figs. 19 and 27.) Thereafter stocks increased, and at the end of the year the total on hand at all merchant plants was 1,314,000 tons and at furnace plants 955,000 tons. (See fig. 27.)

Spot prices of coking coals f. o. b. mines were lower in 1929, and the cost delivered at the ovens also declined. The average cost of coal charged into by-product ovens, which has been falling since 1923 (fig. 26), was $3.57 in 1928 and $3.50 in 1929. Low prices at the mines continued to favor the Appalachian coals in competition with the high-oxygen coking coals of the Middle West; of the 77,065,000 tons purchased for by-product use in 1929 only 564,000 tons came from Illinois and none from Indiana or western Kentucky.

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[1] Work on manuscript completed April, 1931.

The decline in coke prices, which had been a marked feature of the preceding two years, was less apparent in 1929. The spot price of Connellsville furnace coke increased during the first quarter of the year and, although it subsequently declined, the average for 1929 as a whole was above that for 1928. (See fig. 20.) Average realizations on sales of furnace coke by by-product operators also increased. Realizations on by-product domestic coke increased from $6.23 in 1928 to $6.28. (See figs. 26 and 28.)

The general prosperity in 1929 encouraged the building of new by-product ovens. Four new plants began operations during the year: The Rockford Gas Light & Coke Co. at Rockford, Ill.; the Davison Coke & Iron Co. at Neville Island, Pa.; the Philadelphia Coke Co. at Philadelphia; and the Wisconsin Public Service Co. at Sheboygan. Batteries of new ovens were also added at four existing plants, and the number of new ovens under construction at the end of the year was the largest since 1926. On the other hand, the number of beehive ovens declined sharply.

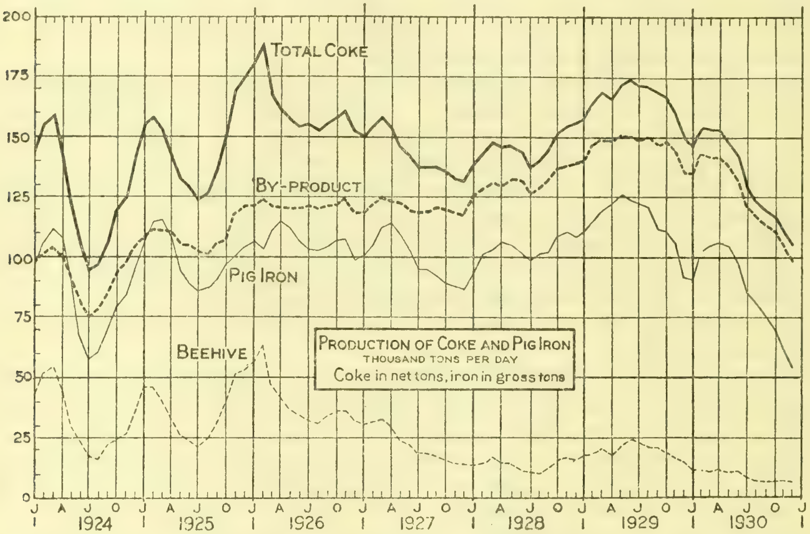

FIGURE 18.—Average daily production of beehive and by-product coke and of pig iron, by months, 1924-1930

In the field of by-products the outstanding development of the last three years has been the recovery of creosote oil. The production by coke operators—including the tar-distillation operation at Clairton—rose from 12,386,000 gallons in 1928 to 26,730,000 gallons in 1929 and has become almost overnight a significant element in the national supply of this indispensable commodity. Four plants reported the recovery of crude phenol from ammonia-still waste, and although the quantity produced was only 85,000 gallons the development offers the possibility of profitable solution of a troublesome problem in waste disposal. Increasing attention was given also to the recovery of by-product sulphur. Other by-products in 1929 continued the tendencies of recent years. The yield of surplus gas again

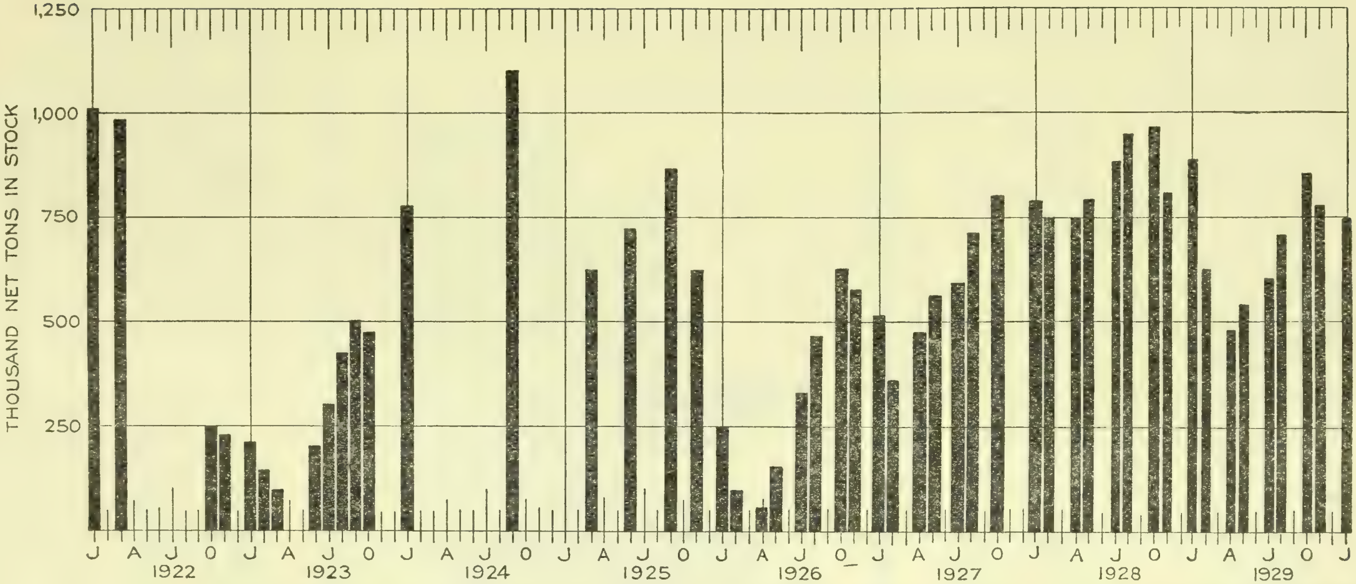

Figure 19.—Stocks of unsold coke on hand at a group of 21 merchant by-product plants, 1922–1929. The figures in this diagram represent a selected group of identical plants only, which have been reporting their stocks since 1922. They are therefore less than the total for all plants shown in Figure 27

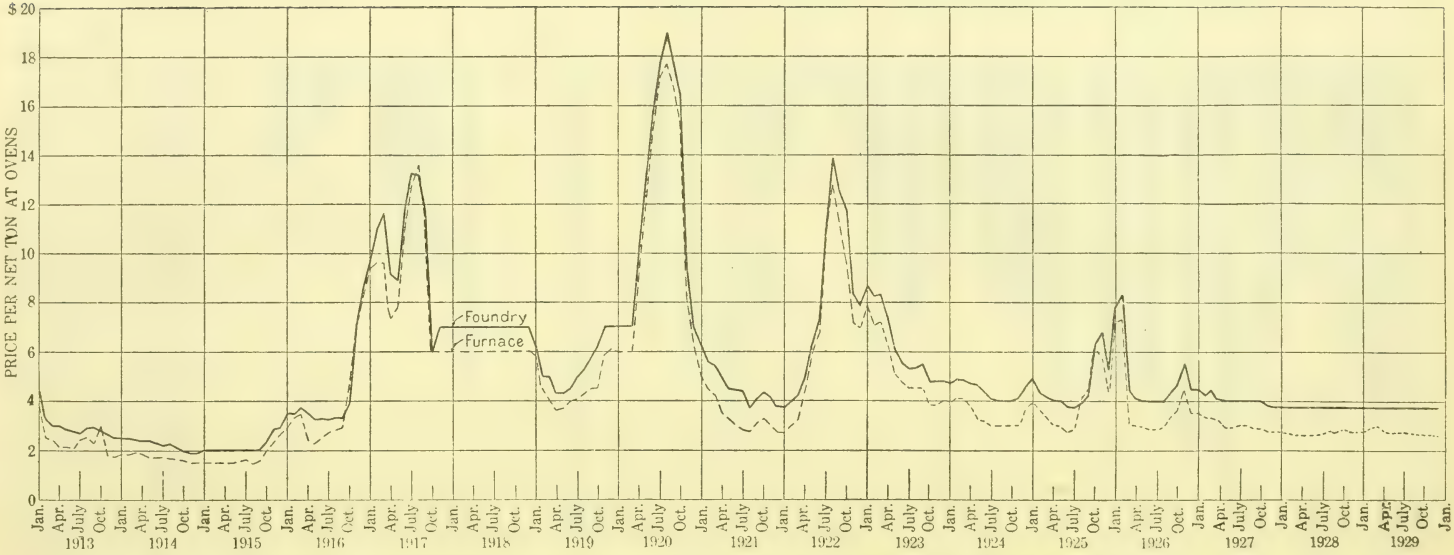

FIGURE 20.—Average monthly prices of spot or prompt Connellsville coke at ovens, 1913–1929, as quoted by Iron Age

increased, largely through the use of producer gas or blast-furnace gas for underfiring. (See fig. 30 and Table 93.) Prices of ammonia continued their steady decline. Average prices received for tar, which had been increasing for some years, declined in 1929. (See fig. 31.)

The gross value of the by-products sold in 1929 (including breeze and tar used by producers but not sold) was $192,000,000, as against only $8,000,000 in 1909. This increase of more than twentyfold in 20 years is perhaps the most striking example of the progress of the by-product coke industry.

ACKNOWLEDGMENTS

This report is made possible by the voluntary cooperation of the producers of coke, who have courteously supplied the statistical data upon which it is based. Special acknowledgment is made of the assistance rendered by the operators of by-product ovens in supplying monthly reports of coke production and stocks and by the railroads in reporting weekly the number of cars of beehive coke loaded for shipment. The United States Engineer Office has courteously supplied monthly reports of shipments on the Monongahela River and other waterways.

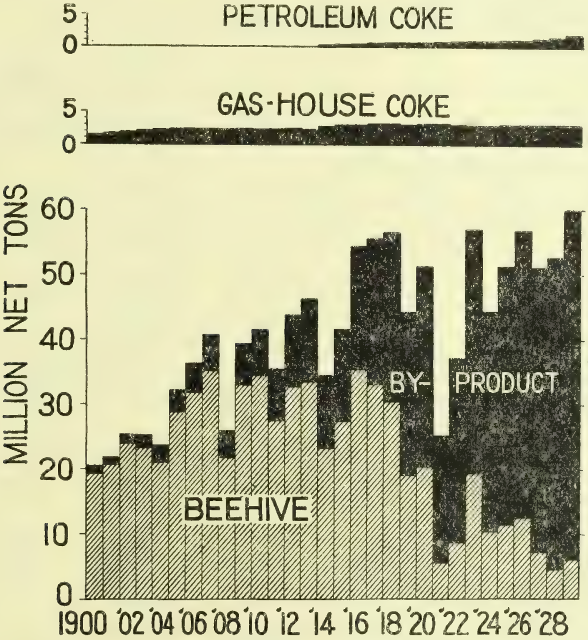

FIGURE 21.—Production of petroleum coke, gas-house coke, and beehive and by-product coke in the United States, 1900–1929. No figures on production of petroleum coke are available before 1914, in which year the production was 213,777 tons

The authors are indebted to W. H. Young for assistance in writing the text.

STATISTICAL SUMMARY

Tables 1, 2, and 3 present the principal statistical facts of the coke industry in 1929.

TABLE 1.—*Salient statistics of the coke industry in 1929*

	By-product	Beehive	Total
Coke produced:			
Quantity ... net tons	53, 411, 826	6, 472, 019	59, 883, 845
Value	$256, 430, 168	$22, 564, 424	$278, 994, 592
Screenings and breeze produced:			
Quantity ... net tons	4, 852, 720	225, 399	5, 078, 119
Value	$10, 651, 428	$191, 871	$10, 843, 299
Coal charged into ovens:			
Quantity ... net tons	76, 758, 958	10, 027, 516	86, 786, 474
Value	$268, 932, 261	$18, 416, 340	$287, 348, 601
Average value	$3. 50	$1. 84	$3. 31
Average yield in per cent of coal charged:			
Coke	69. 6	64. 5	69. 0
Breeze (at plants actually recovering)	6. 3	4. 1	6. 2
Ovens:			
In existence Jan. 1	12, 544	41, 288	53, 832
In existence Dec. 31	12, 649	30, 082	42, 731
Dismantled during year	245	11, 611	11, 856
In course of construction Dec. 31	408	--------------	408
Daily capacity of ovens in existence Dec. 31 ... net tons	164, 840	(1)	(1)
Coke used by operator:			
In blast furnaces—			
Quantity ... do	35, 755, 470	901, 593	36, 657, 063
Value	$151, 697, 575	$3, 467, 955	$155, 165, 530
For other purposes—			
Quantity ... net tons	1, 285, 771	31, 802	1, 317, 573
Value	$8, 446, 467	$233, 007	$8, 679, 474
Disposal of coke:			
Sold for furnace use to affiliated corporations—			
Quantity ... net tons	3, 470, 115	1, 174, 374	4, 644, 489
Value	$16, 941, 539	$4, 576, 983	$21, 518, 522
Merchant sales of furnace coke—			
Quantity ... net tons	1, 351, 483	2, 815, 114	4, 166, 597
Value	$7, 268, 653	$8, 236, 242	$15, 504, 895
Sold for foundry use—			
Quantity ... net tons	2, 114, 690	773, 818	2, 888, 508
Value	$14, 730, 679	$3, 380, 845	$18, 111, 524
Sold for domestic use—			
Quantity ... net tons	7, 376, 320	134, 703	7, 511, 023
Value	$46, 297, 848	$500, 330	$46, 798, 178
Sold for industrial and other use—			
Quantity ... net tons	1, 693, 223	641, 776	2, 334, 999
Value	$9, 771, 396	$2, 145, 176	$11, 916, 572
Disposal of screenings and breeze:			
Used by operator—			
Quantity ... net tons	3, 801, 075	75, 339	3, 876, 414
Value	$7, 710, 611	$50, 791	$7, 761, 402
Sold—			
Quantity ... net tons	922, 693	37, 390	960, 083
Value	$2, 598, 778	$50, 790	$2, 649, 568
Average receipts per ton sold:			
Furnace coke (merchant sales)	$5. 38	$2. 93	$3. 72
Foundry coke	$6. 97	$4. 37	$6. 27
Domestic coke	$6. 28	$3. 71	$6. 23
Other industrial coke	$5. 77	$3. 34	$5. 10
Screenings and breeze	$2. 82	$1. 36	$2. 76
By-products produced:			
Gas ... M cubic feet	843, 148, 089	--------------	843, 148, 089
Wasted ... per cent	2. 2	--------------	2. 2
Burned in coking process ... do	37. 6	--------------	37. 6
Surplus sold or used ... do	60. 2	--------------	60. 2
Tar ... gallons	680, 864, 366	--------------	680, 864, 366
Ammonium sulphate or equivalent ... pounds	1, 712, 427, 835	--------------	1, 712, 427, 835
Crude light oil ... gallons	200, 594, 027	--------------	200, 594, 027
Yield of by-products per ton of coal:			
Gas ... M cubic feet	11. 0	--------------	11. 0
Tar ... gallons	8. 9	--------------	8. 9
Ammonium sulphate or equivalent ... pounds	22. 3	--------------	22. 3
Crude light oil ... gallons	2. 9	--------------	2. 9
Value of by-products sold:			
Gas (surplus)	$84, 304, 270	--------------	$84, 304, 270
Tar—			
Sold	$16, 982, 406	--------------	$16, 982, 406
Used by producer	$17, 712, 650	--------------	$17, 712, 650
Ammonium sulphate or equivalent	$28, 682, 281	--------------	$28, 682, 281
Crude light oil and derivatives	$30, 904, 012	--------------	$30, 904, 012
Other by-products[2]	$2, 802, 602	--------------	$2, 802, 602
Total value of coke, breeze, and by-products[3]	$448, 469, 817	$22, 756, 295	$471, 226, 112

[1] Data not available.
[2] Includes naphthalene.
[3] Includes value of tar used by the coke plants.

TABLE 2.—*Statistical trends of the coke industry, 1915, 1923, and 1926–1929*

	1915	1923	1926	1927	1928	1929
Coke produced:						
Beehive net tons	27, 508, 255	19, 379, 870	12, 488, 951	7, 207, 417	4, 492, 803	6, 472, 019
By-product do	14, 072, 895	37, 597, 664	44, 376, 586	43, 884, 726	48, 313, 025	53, 411, 826
Total do	41, 581, 150	56, 977, 534	56, 865, 537	51, 092, 143	52, 805, 828	59, 883, 845
Per cent of total from by-product ovens	33. 8	66. 0	78. 0	85. 9	91. 5	89. 2
Disposal of coke (beehive and by-product):						
Furnace coke (including all coke used by producer) net tons	(1)	47, 774, 408	45, 019, 560	40, 317, 130	41, 952, 336	46, 785, 722
Foundry coke do	(1)	3, 600, 719	3, 331, 677	2, 748, 243	2, 710, 606	2, 888, 508
Other industrial do	(1)	2, 283, 888	2, 626, 634	2, 592, 587	1, 764, 374	2, 334, 999
Domestic coke do	(1)	2, 733, 414	5, 442, 613	4, 813, 632	6, 332, 720	7, 511, 023
Number of ovens in existence:						
Beehive	93, 110	62, 349	52, 558	49, 795	46, 288	30, 082
By-product	6, 268	11, 156	11, 716	12, 475	12, 544	12, 649
Number of new by-product ovens under construction at end of year	1, 191	629	978	289	145	408
Cost of coal charged, by-product ovens, average per ton	$2. 33	$4. 76	$3. 88	$3. 87	$3. 57	$3. 50
Prices of coke:						
Average spot price of Connellsville furnace coke f. o. b. ovens	$1. 73	$5. 33	$3. 92	$3. 04	$2. 69	$2. 75
Average realization on by-product coke sold—						
Furnace coke (merchant sales)	(1)	$6. 74	$6. 25	$5. 42	$4. 99	$5. 38
Foundry coke	(1)	$10. 54	$7. 77	$7. 80	$6. 98	$6. 97
Other industrial	(1)	$9. 06	$7. 39	$6. 83	$6. 58	$5. 77
Domestic	(1)	$9. 05	$7. 43	$6. 90	$6. 23	$6. 28
Yield of by-products per ton of coal charged:						
Tar gallons	7. 1	8. 1	8. 3	8. 6	9. 0	8. 9
Ammonium sulphate or equivalent pounds	20. 1	21. 2	21. 7	22. 7	22. 8	22. 3
Light oil gallons	1. 5	2. 7	2. 8	2. 9	3. 0	2. 9
Surplus gas sold or used M cu. ft	4. 3	5. 9	6. 2	6. 5	6. 5	6. 6
Average gross receipts of by-products per ton of coke produced:						
Tar sold or used	$0. 25	$0. 51	$0. 60	$0. 66	$0. 69	$0. 65
Ammonia and its compounds	$0. 70	$0. 84	$0. 63	$0. 62	$0. 57	$0. 54
Light oil and its derivatives	$0. 52	$0. 51	$0. 62	$0. 58	$0. 60	$0. 58
Surplus gas sold or used	$0. 61	$1. 37	$1. 46	$1. 60	$1. 58	$1. 58
Total by-products including breeze	$2. 19	$3. 48	$3. 52	$3. 66	$3. 66	$3. 60

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[1] No data.

TABLE 3.—*Summary of coke produced, value, number of ovens, coal charged, and average yield, by States, 1928 and 1929*

[Exclusive of screenings and breeze]

State	By-product								Beehive						Total	
	Plants in existence	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens		Ovens	Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens		Coke produced (net tons)	Value of coke at ovens
		Built	Under construction Dec. 31				Total	Per ton					Total	Per ton		
1928																
Alabama	8	1,388		6,215,804	69.6	4,327,324	$13,260,178	$3.06	953						4,327,324	$13,260,178
Colorado	1	120		891,315	68.0	605,822	(1)	(1)	1,498	220,515	65.4	144,200	(1)	(1)	750,022	(1)
Connecticut	1	61		(2)	(2)	(2)	(2)	(2)							(2)	(2)
Georgia										(2)	(2)	(2)	(2)	(2)	(2)	(2)
Illinois	8	937	21	4,712,289	68.8	3,240,964	19,967,463	6.16							3,240,964	19,967,463
Indiana	7	1,384		8,202,943	74.3	6,094,201	38,237,790	6.27							6,094,201	38,237,790
Kentucky	1	108		(2)	(2)	(2)	(2)	(2)	608	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Maryland	1	360		1,635,668	72.5	1,186,398	(1)	(1)							1,186,398	(1)
Massachusetts	3	381		1,035,336	66.4	687,356	5,269,890	7.67							687,356	5,269,890
Michigan	7	576		3,397,164	70.6	2,399,656	13,461,466	5.61							2,399,656	13,461,466
Minnesota	3	196		899,938	69.2	622,696	5,816,566	9.34							622,696	5,816,566
Missouri	1	64		(2)	(2)	(2)	(2)	(2)							(2)	(2)
New Jersey	2	207		1,252,990	72.1	903,177	(1)	(1)							903,177	(1)
New Mexico									584							
New York	9	868		5,501,162	69.1	3,802,657	25,033,649	6.58							3,802,657	25,033,649
Ohio	16	1,820	15	11,466,044	67.9	7,786,199	33,908,863	4.35	202	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Oklahoma									100							
Pennsylvania	11	3,235	109	20,325,663	66.3	13,475,349	51,132,406	3.79	27,552	5,266,357	65.4	3,442,006	$11,515,366	$3.35	16,917,355	62,647,772
Rhode Island	1	40		(2)	(2)	(2)	(2)	(2)							(2)	(2)
Tennessee	1	24		151,424	74.7	113,134	606,398	5.36	1,415	173,706	59.8	103,791	457,489	4.41	216,925	1,063,887
Utah	1	56		448,350	55.0	246,503	(1)	(1)	819	48,675	57.7	28,097	(1)	(1)	274,600	(1)
Virginia									2,914	420,765	58.9	247,734	1,052,016	4.25	247,734	1,052,016
Washington	1	20		64,458	63.2	40,755	285,285	7.00	235	29,353	63.9	18,747	151,902	8.06	59,502	437,187
West Virginia	4	411		1,966,364	69.5	1,367,481	3,761,460	2.75	4,408	733,504	58.8	431,419	1,543,933	3.58	1,798,900	5,305,393
Wisconsin	2	288		(2)	(2)	(2)	(2)	(2)							(2)	(2)
Combined States				1,998,994	70.7	1,413,353	9,682,047	6.85		125,099	61.4	76,809	406,691	5.29	9,276,361	43,997,601
Undistributed							16,091,743						1,191,159			17,282,902
	89	12,544	145	70,165,906	68.9	48,313,025	236,515,204	4.90	41,288	7,017,974	64.0	4,492,803	16,318,556	3.63	52,805,828	252,833,760

1929																
Alabama	8	1,388	-------	6,708,774	70.9	4,753,967	12,659,148	2.66	-------	-------	-------	-------	-------	-------	4,753,967	12,659,148
Colorado	1	120	-------	830,748	68.0	565,031	(1)	(1)	378	237,926	65.7	156,426	(1)	(1)	721,457	(1)
Connecticut	1	61	-------	(2)	(2)	(2)	(2)	(2)	-------	-------	-------	-------	-------	-------	(2)	(2)
Illinois	8	905	45	5,984,119	70.3	4,204,116	26,036,197	6.19	-------	-------	-------	-------	-------	-------	4,204,116	26,036,197
Indiana	7	1,498	-------	8,748,928	73.8	6,455,378	41,208,876	6.38	-------	-------	-------	-------	-------	-------	6,455,378	41,208,876
Kentucky	1	108	-------	(2)	(2)	(2)	(2)	(2)	200	-------	-------	-------	-------	-------	(2)	(2)
Maryland	1	300	61	1,914,048	72.8	1,393,052	(1)	(1)	-------	-------	-------	-------	-------	-------	1,393,052	(1)
Massachusetts	3	381	82	1,126,370	69.0	776,679	5,919,159	7.62	-------	-------	-------	-------	-------	-------	776,679	5,919,159
Michigan	7	576	-------	3,760,441	71.3	2,679,971	14,867,651	5.55	-------	-------	-------	-------	-------	-------	2,679,971	14,867,651
Minnesota	3	196	-------	1,062,179	70.2	746,004	6,478,228	8.68	-------	-------	-------	-------	-------	-------	746,004	6,478,228
Missouri	1	64	-------	(2)	(2)	(2)	(2)	(2)	-------	-------	-------	-------	-------	-------	(2)	(2)
New Jersey	2	207	-------	1,248,662	71.9	897,530	(1)	(1)	-------	-------	-------	-------	-------	-------	897,530	(1)
New York	9	868	37	6,183,918	69.5	4,299,470	25,305,915	5.89	-------	-------	-------	-------	-------	-------	4,299,470	25,305,915
Ohio	15	1,811	-------	12,316,686	69.2	8,521,132	35,202,383	4.13	202	(3)	(3)	(3)	(3)	(3)	[4] 8,521,132	[4] 35,202,383
Oklahoma									100							
Pennsylvania	13	3,420	158	21,643,559	66.9	14,489,283	55,088,803	3.80	22,790	[3] 8,195,528	[3] 65.5	[3] 5,367,685	[3] 17,824,426	[3] 3.32	[3] 19,856,968	[3] 72,913,229
Rhode Island	1	40	25	(2)	(2)	(2)	(2)	(2)	-------	-------	-------	-------	-------	-------	(2)	(2)
Tennessee	1	24	-------	160,842	70.4	113,285	672,913	5.94	723	169,385	56.6	95,881	413,461	4.31	209,166	1,086,374
Utah	1	56	-------	493,945	54.2	267,939	(1)	(1)	819	23,361	60.2	14,055	(1)	(1)	281,994	(1)
Virginia	-------	-------	-------	-------	-------	-------	-------	-------	1,742	527,280	59.7	314,859	1,283,740	4.08	314,859	1,283,740
Washington	1	20	-------	65,845	62.1	40,879	286,153	7.00	190	34,894	74.1	25,844	207,674	8.04	66,723	493,827
West Virginia	4	411	-------	2,056,475	69.6	1,431,314	3,610,883	2.52	2,938	839,142	59.3	497,269	1,675.544	3.37	1,928,583	5,286,427
Wisconsin	2	195	-------	(2)	(2)	(2)	(2)	(2)	-------	-------	-------	-------	-------	-------	(2)	(2)
Combined States	-------	-------	-------	2,453,419	72.4	1,776,796	12,668,372	7.13	-------	-------	-------	-------	-------	-------	1,776,796	12,668,372
Undistributed	-------	-------	-------	-------	-------	-------	16,425,487	5.26	-------	-------	-------	-------	1,159,579	6.80	-------	17,585,066
	90	12,649	408	76,758,958	69.6	53,411,826	256,430,168	4.80	30,082	10,027,516	64.5	6,472,019	22,564,424	3.49	59,883,845	278,994,592

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[1] Included under "Undistributed."
[2] Included under "Combined States."
[3] A small amount of beehive coke, produced in Ohio, is included with Pennsylvania.
[4] By-product only; beehive included with Pennsylvania.

SCOPE OF REPORT

DEFINITIONS OF TERMS USED IN STATISTICAL TABLES

The standard unit of measurement in the coke industry in the United States is the short or net ton of 2,000 pounds; unless other notation is made it is the unit employed throughout this chapter.

The term "coke" does not include breeze or fine coke screenings, because operators in general, especially those in the beehive industry, do not regard this fine material as properly so classified. No effort has been made to define accurately the limitation as to size between coke and breeze, and each operator has followed his own regular practice in reporting his output of fine material to the Bureau of Mines. It is probably safe to say, however, that coke breeze and screenings correspond closely in size to the anthracite usually classified as steam sizes; in other words, they include material smaller than pea coal.

ACCOUNTING PRACTICES OF COKE OPERATORS THAT AFFECT STATISTICS

The term "value" as applied to coke in this report means the value at the ovens. For the part of the output that is sold the value is obviously the amount received for the coke f. o. b. ovens, but a considerable proportion of the coke produced in the United States is made in ovens operated by large corporations that not only mine the coal and make the coke but also have blast furnaces and steel mills that consume the entire product of the ovens. Under such conditions fixing a value upon the coke and upon the coal consumed in making it is largely arbitrary. Some corporations charge the coke to the furnace department at cost; others add a percentage of profit or base the reported value on what the coke would cost if purchased.

These differences in accounting practice also affect the relative proportions of the output reported as "sold" and as "used by producer." Between the blast furnaces, which are the largest users of coke, and the coke plants there is a close business relation that at many plants amounts to identity of ownership. Among such affiliated interests the line between sales and interdepartmental transfers is difficult to draw, and a large part of the furnace coke reported as sold actually goes to iron furnaces that are in some way connected with the coke companies. (See Tables 40 and 41.)

SIX COKE-PRODUCING INDUSTRIES

In the United States coke is produced by a group of six different industries. In addition to that made in the familiar beehive and by-product ovens coke is obtained in the manufacture of coal gas, in plants carbonizing coal at low temperatures, in the refining of petroleum, and in the distillation of coal tar. The coke produced, however, differs greatly in character, and the problems affecting each of these industries are separate and distinct.

BEEHIVE AND BY-PRODUCT OVEN COKE

Scope of this report—beehive and by-product coke.—Neither petroleum coke, low-temperature coke, nor gas-house coke is adapted for blast-furnace and foundry purposes, the uses that consume the great bulk of all coke produced, and the production of coal-tar coke is so limited as to have small importance. Practically, therefore, the coke trade is concerned with beehive and by-product oven coke, and the statistics of this report are confined to these two types, except as specifically noted. The dominant position of beehive and by-product coke in the total supply of coke of all kinds is shown by Figure 21. Although their products are interchangeable there are fundamental differences between the beehive and by-product industries which must be kept in mind when the tables in this chapter are examined. The competitive relations between the beehive and by-product industries have been discussed in previous reports of this series and need not be treated here. (See Coke and By-Products in 1924, pp. 666–667.) Market conditions continue to foster the development of by-product coking, and the manufacture of beehive coke assumes more and more the character of an auxiliary agency called upon to furnish only the peak requirements of the metallurgical industry in times of active business.

By-product ovens operated by city gas companies included.—Between the by-product coke and the city-gas industries the line is increasingly difficult to draw. Adaptation of the by-product coke oven to the needs of city gas manufacture has led a number of gas utility companies to install batteries of by-product ovens to supplement or even replace their coal or water gas plants. From the point of view of ownership and accounting these installations are a part of the gas utility system, and the Bureau of the Census therefore groups them with the manufactured-gas industry under the title "Gas, manufactured, illuminating and heating."

But from other points of view these installations belong to the by-product coke industry. The coke they produce is superior to gas-house coke. In the practical operation of a by-product coke plant the fact that the gas may be distributed through city mains is often of less consequence than the fact that the coke must be marketed for foundry, furnace, or household use. Considered with reference to oven design and the technique of manufacture and still more with reference to the supply and demand for coke, they should be included with other by-product coke plants, and they are so included in the statistics published by the Bureau of Mines.

These differences in classification are followed advisedly by the Bureau of the Census and the Bureau of Mines after consultation with leaders of the gas and coke industries, and the two offices have collaborated in the collection and analysis of the statistics. In order to enable the reader to reconcile the two sets of figures and to ascertain the total production of gas and coke from all sources without duplication, tables are given on pages 667 to 668 of this report, in which the production of those by-product ovens operated by city gas companies is shown separately.

GAS-HOUSE COKE

Gas-house coke, like beehive and by-product oven coke, is produced by carbonization of coal at high temperatures. For many years coke produced in horizontal retorts has been a factor in the local fuel market of communities supplied with coal gas. Such retort coke is regarded as a by-product, the primary product being the gas. Because of differences in methods of manufacture and because the coals used are commonly selected for the quality and volume of the gas evolved rather than for their coking properties the coke formed is too soft and friable and too irregular in size and quality for blast-furnace or foundry use. It is, however, suitable for the manufacture of water gas, a fact that has led many gas companies to combine water-gas machines and coal-gas retorts in the same plant. For many years between a third and a half of the gas-house coke produced has been used for making water gas, for heating retorts, or for boiler fuel about the plant where it was made. The remainder was disposed of in the local market, largely as domestic fuel.

Recent years have witnessed an improvement in the quality of gas-house coke in many communities. Greater care has been exercised in screening and sizing the product, and numerous installations of horizontal retorts have been replaced with continuous vertical retorts or with small horizontal gas ovens resembling miniature coke ovens.[2] The total production of gas-house coke in 1927, the latest year for which accurate figures are available, was 2,845,189 tons, of which 1,484,268 tons was sold, presumably for domestic use. (See Table 4.) This includes not only coke from horizontal retorts but also from all other types of high-temperature carbonizing equipment except coke ovens. A considerable proportion of this, beyond doubt, represents small horizontal-oven coke.

TABLE 4.—*Gas-house coke produced and sold in the United States, 1915–1929*

[Figures include coke made in all types of high-temperature carbonizing equipment other than coke ovens]

Year	Production (net tons)	Sales (net tons)	Value of sales	
			Total	Average per net ton
1915 [1]	2,940,926	1,662,552	$7,198,377	$4.33
1917 [1]	3,094,966	1,857,248	10,953,693	5.90
1918 [1]	3,180,535	1,813,740	13,963,232	7.70
1919 [2]	3,035,570	1,485,758	(3)	(3)
1920 [1]	3,137,332	1,378,537	11,638,525	8.44
1921 [2]	3,159,490	1,586,728	(3)	(3)
1922 [1]	2,877,787	1,387,658	12,032,244	8.67
1923 [2]	2,779,993	1,438,463	(3)	(3)
1924	(3)	[4] 1,400,000	(3)	(3)
1925 [2]	2,907,018	1,368,704	(3)	(3)
1926	(3)	[4] 1,400,000	(3)	(3)
1927 [2]	2,845,189	1,484,268	13,642,686	9.19
1928	(3)	[4] 1,450,000	(3)	(3)
1929	(3)	[4] 1,400,000	(3)	(3)

[1] Reported by the gas companies direct to the U. S. Geological Survey.

[2] Obtained by subtracting from the total for all manufactured-gas plants (public utilities) as reported by the Census of Manufactures the figures reported to the Bureau of Mines for those by-product coke plants that are counted by the census as a part of the manufactured-gas industry. See Table 100, p. 667, for a recapitulation of the operations of these by-product plants.

[3] No data.

[4] Estimated by interpolation.

LOW-TEMPERATURE COKE

In the United States, as elsewhere, much experimental work has been done in the field of low-temperature carbonization of coal. In 1929 low-temperature coke was produced on a commercial scale by a plant at New Brunswick, N. J., said to be the largest of its kind in the world. The plant has an annual capacity of 250,000 tons of coal and uses the KSG process, which takes its name from the Kohlenscheidungs-Gesellschaft.[3] Statistics of its production can not be published without disclosing individual operations.

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[2] McBride, R. S., Miniature Coke Ovens to Serve the Small Community: Am. Gas Jour., July, 1927, pp. 27–31.

Unexpected difficulties were encountered by the New Brunswick plant, and after a few months of operation it was shut down.[4] On the other hand, the company's original plant near Essen, Germany, is said to have operated successfully for several years.

PETROLEUM COKE

The methods of refining crude oil now generally used in the United States yield a solid residue known as petroleum coke. Its physical properties are much like those of coke made from coal, except that it is finer in texture, lacks the strength required for blast-furnace or foundry coke, and is extraordinarily low in ash, probably averaging not more than 1.5 per cent. In 1929 the total production of petroleum coke amounted to 1,820,600 tons. Because of its extremely low ash content petroleum coke is in demand as a source of comparatively pure carbon and is widely used in the manufacture of carbon electrodes, electric-furnace resisters, and dry cells. The demand for this purpose, however, absorbs only a small fraction of the supply; and the bulk of the output is now used for other purposes, chief of which are fuel at petroleum refineries, domestic fuel in homes, and pulverized fuel in industries and power plants. The subject is treated in detail by E. B. Swanson, of the Bureau of Mines, in Economic Paper 9, Petroleum Coke: An Economic Survey of its Production and Uses. The total production of petroleum coke in recent years, as reported by G. R. Hopkins, also of the bureau, is shown in Table 5.

TABLE 5.—*Petroleum coke produced and in stock in the United States, 1918–1929, in net tons*

Year	Production	Stock at end of year	Year	Production	Stock at end of year
1918	559, 663	22, 605	1924	761, 095	97, 844
1919	603, 459	21, 146	1925	990, 991	238, 403
1920	576, 613	31, 469	1926	995, 308	290, 582
1921	604, 465	74, 508	1927	1, 145, 200	345, 100
1922	707, 064	35, 722	1928	1, 426, 000	436, 900
1923	672, 526	26, 264	1929	1, 820, 600	745, 400

COAL-TAR PITCH COKE

Recent developments have made available another form of coke—that derived from coal-tar pitch. The product, which is known as pitch coke, is not to be confused with the tar-still coke sometimes obtained as the end product of the distillation of tar. Tar-still coke is too soft for metallurgical use and has relatively slight value; for this and other reasons it is common practice to run the pitch out of the stills before it reaches the stage of coking. By introducing the pitch into a coke oven, however, and by coking it, an excellent metallurgical coke may be produced, which is unusually hard and firm, contains only 0.3 per cent of ash, and is very low in sulphur. Pitch coke has proved itself well adapted to metallurgical use and often commands a premium over coke made from coal. The manufacture of pitch coke is established commercially but has not yet reached the stage where publication of statistics on the subject is expedient. The Barrett Co., of 40 Rector Street, New York City, can supply information on the subject.

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[3] The plant is described by R. S. McBride in An Economic Test of Low-Temperature Coking: Chem. and Met. Eng., May, 1929, p. 288.

[4] Chemical and Metallurgical Engineering, January, 1930, p. 33.

COKE AND COKE BREEZE

GROWTH OF INDUSTRY

TABLE 6.—*By-product and beehive coke produced in the United States, 1880–1929, in net tons*

Year	By-product	Beehive	Total	Year	By-product	Beehive	Total
1880		3, 338, 300	3, 338, 300	1905	3, 462, 348	28, 768, 781	32, 231, 129
1881		4, 113, 760	4, 113, 760	1906	4, 558, 127	31, 843, 090	36, 401, 217
1882		4, 793, 321	4, 793, 321	1907	5, 607, 899	35, 171, 665	40, 779, 564
1883		5, 464, 721	5, 464, 721	1908	4, 201, 226	21, 832, 292	26, 033, 518
1884		4, 873, 805	4, 873, 805	1909	6, 254, 644	33, 060, 421	39, 315, 065
1885		5, 106, 696	5, 106, 696	1910	7, 138, 734	34, 570, 076	41, 708, 810
1886		6, 845, 369	6, 845, 369	1911	7, 847, 845	27, 703, 644	35, 551, 489
1887		7, 611, 705	7, 611, 705	1912	11, 115, 164	32, 868, 435	43, 983, 599
1888		8, 540, 030	8, 540, 030	1913	12, 714, 700	33, 584, 830	46, 299, 530
1889		10, 258, 022	10, 258, 022	1914	11, 219, 943	23, 335, 971	34, 555, 914
1890		11, 508, 021	11, 508, 021	1915	14, 072, 895	27, 508, 255	41, 581, 150
1891		10, 352, 688	10, 352, 688	1916	19, 069, 361	35, 464, 224	54, 533, 585
1892		12, 010, 829	12, 010, 829	1917	22, 439, 280	33, 167, 548	55, 606, 828
1893	12, 850	9, 464, 730	9, 477, 580	1918	25, 997, 580	30, 480, 792	56, 478, 372
1894	16, 500	9, 187, 132	9, 203, 632	1919	25, 137, 621	19, 042, 936	44, 180, 557
1895	18, 521	13, 315, 193	13, 333, 714	1920	30, 833, 951	20, 511, 092	51, 345, 043
1896	83, 038	11, 705, 735	11, 788, 773	1921	19, 749, 580	5, 538, 042	25, 287, 622
1897	261, 912	13, 027, 072	13, 288, 984	1922	28, 550, 545	8, 573, 467	37, 124, 012
1898	294, 445	15, 752, 764	16, 047, 209	1923	37, 597, 664	19, 379, 870	56, 977, 534
1899	906, 534	18, 762, 035	19, 668, 569	1924	33, 983, 568	10, 286, 037	44, 269, 605
1900	1, 075, 727	19, 457, 621	20, 533, 348	1925	39, 912, 159	11, 354, 784	51, 266, 943
1901	1, 179, 900	20, 615, 983	21, 795, 883	1926	44, 376, 586	12, 488, 951	56, 865, 537
1902	1, 403, 588	23, 998, 142	25, 401, 730	1927	43, 884, 726	7, 207, 417	51, 092, 143
1903	1, 882, 394	23, 391, 887	25, 274, 281	1928	48, 313, 025	4, 492, 803	52, 805, 828
1904	2, 608, 229	21, 052, 877	23, 661, 106	1929	53, 411, 826	6, 472, 019	59, 883, 845

TABLE 7.—*Statistical summary illustrating growth of the coke industry in the United States, 1880–1929*

Year	Production (million net tons)			Per cent of total production from by-product ovens	Number of ovens in existence		Number of by-product ovens under construction at end of year	Coal charged (million net tons)	Yield of coke from coal (per cent)	Average value of coke per ton at plant	Total value at plant (million dollars)			
	By-product	Beehive	Total		By-product	Beehive					Beehive coke	By-product coke	All by-products[1]	Total coke and by-products
1880	------	3. 3	3. 3	------	--------	12, 372	-------	5. 2	63. 7	$1. 99	7	------	------	7
1881	------	4. 1	4. 1	------	--------	14. 119	-------	6. 5	62. 8	1. 88	8	------	------	8
1882	------	4. 8	4. 8	------	--------	16, 356	-------	7. 6	63. 3	1. 77	8	------	------	8
1883	------	5. 5	5. 5	------	--------	18, 304	-------	8. 5	64. 2	1. 49	8	------	------	8
1884	------	4. 9	4. 9	------	--------	19, 557	-------	8. 0	61. 3	1. 49	7	------	------	7
1885	------	5. 1	5. 1	------	--------	20, 116	-------	8. 1	63. 3	1. 49	8	------	------	8
1886	------	6. 8	6. 8	------	--------	22, 597	-------	10. 7	64. 0	1. 63	11	------	------	11
1887	------	7. 6	7. 6	------	--------	26, 001	-------	11. 9	64. 2	2. 01	15	------	------	15
1888	------	8. 5	8. 5	------	--------	30, 059	-------	12. 9	66. 0	1. 46	12	------	------	12
1889	------	10. 3	10. 3	------	--------	34, 165	-------	16. 0	64. 3	1. 62	17	------	------	17
1890	------	11. 5	11. 5	------	--------	37, 158	-------	18. 0	63. 9	2. 02	23	------	------	23
1891	------	10. 4	10. 4	------	--------	40, 057	-------	16. 3	63. 3	1. 97	20	------	------	20
1892	------	12. 0	12. 0	------	--------	42, 002	-------	18. 8	63. 8	1. 96	24	------		24
1893	0. 01	9. 5	9. 5	0. 1	12	44, 189	-------	14. 9	63. 5	1. 74	17		(2)	(2)
1894	. 02	9. 2	9. 2	. 2	12	44, 760	60	14. 4	64. 0	1. 34	12		(2)	(2)

[1] The value for tar up to and including 1917 represented that of the tar "obtained and sold," which did not always include the value of tar used by the producer. Beginning with 1918, tar used by the producer is specifically included. The value of breeze produced at by-product plants is included for those years for which it was reported, namely, 1916, 1917, and 1919–1929. The value of breeze produced at beehive plants is not included, as it has usually been much less than a million dollars.

[2] No accurate data on the value of the by-products available

TABLE 7.—*Statistical summary illustrating growth of the coke industry in the United States, 1880–1929*—Continued

Year	Production (million net tons)			Per cent of total production from by-product ovens	Number of ovens in existence		Number of by-product ovens under construction at end of year	Coal charged (million net tons)	Yield of coke from coal (per cent)	Average value of coke per ton at plant	Total value at plant (million dollars)			
	By-product	Beehive	Total		By-product	Beehive					Beehive coke	By-product coke	All by-products	Total coke and by-products
1895	0.02	13.3	13.3	0.1	72	45,493	60	20.8	64.0	$1.44	19		(1)	(1)
1896	.1	11.7	11.8	.7	160	46,784	120	18.7	63.1	1.84	22		(1)	(1)
1897	.3	13.0	13.3	2.0	280	47,388	240	20.9	63.6	1.66	22		(1)	(1)
1898	.3	15.7	16.0	1.8	520	47,863	500	25.2	63.6	1.59	26		(1)	(1)
1899	.9	18.8	19.7	4.6	1,020	48,583	65	30.2	65.1	1.76	35		(1)	(1)
1900	1.1	19.4	20.5	5.2	1,085	57,399	1,096	32.1	63.9	2.31	47		(1)	(1)
1901	1.2	20.6	21.8	5.4	1,165	62,786	1,533	34.2	63.7	2.04	44		------	------
1902	1.4	24.0	25.4	5.5	1,663	67,406	1,346	39.6	64.1	2.49	63		(1)	(1)
1903	1.9	23.4	25.3	7.4	1,956	77,378	1,335	39.4	64.1	2,63	66		(1)	(1)
1904	2.6	21.1	23.7	11.0	2,910	80,689	832	36.5	64.8	1.95	46		(1)	(1)
1905	3.4	28.8	32.2	10.7	3,103	84,405	417	49.5	65.1	2.25	72		(1)	(1)
1906	4.6	31.8	36.4	12.5	3,547	90,354	112	55.7	65.3	2.52	92		(1)	(1)
1907	5.6	35.2	40.8	13.8	3,684	95,996	330	61.9	65.8	2.74	90	22	8	120
1908	4.2	21.8	26.0	16.1	3,799	97,419	240	39.4	66.0	2.40	48	14	7	69
1909	6.2	33.1	39.3	15.9	3,989	99,993	949	59.4	66.2	2.29	70	20	8	98
1910	7.1	34.6	41.7	17.1	4,078	100,362	1,200	63.1	66.1	2.39	75	25	8	108
1911	7.9	27.7	35.6	22.1	4.624	99,255	698	53.3	66.7	2.37	57	27	10	94
1912	11.1	32.9	44.0	25.3	5,211	97,019	793	65.6	67.1	2.54	69	43	14	126
1913	12.7	33.6	46.3	27.5	5,688	96,962	504	69.2	66.9	2.78	80	49	17	146
1914	11.2	23.4	34.6	32.5	5,809	93,946	644	51.6	66.9	2.56	50	38	18	106
1915	14.1	27.5	41.6	33.8	6,268	93,110	1,191	61.8	67.2	2.54	57	49	30	136
1916	19.1	35.4	54.5	35.0	7,283	91,581	2,084	81.6	66.8	3.13	96	75	62	233
1917	22.4	33.2	55.6	40.4	7,869	88,027	2,260	83.8	66.4	5.36	159	139	68	366
1918	26.0	30.5	56.5	46.0	9,279	84,635	1,815	85.0	66.4	6.77	189	193	77	459
1919	25.1	19.1	44.2	56.9	10,379	82,560	877	65.6	67.4	5.85	98	160	68	326
1920	30.8	20.5	51.3	60.0	10,881	75,298	396	76.2	67.4	9.27	163	313	105	581
1921	19.8	5.5	25.3	78.1	11,142	66,014	85	37.2	68.0	5.84	30	118	68	216
1922	28.5	8.6	37.1	76.9	11,212	63,958	403	54.3	68.3	6.42	50	188	95	333
1923	37.6	19.4	57.0	66.0	11,156	62,349	629	84.4	67.5	6.56	116	257	131	504
1924	34.0	10.3	44.3	76.8	11,413	60,432	247	65.0	68.1	5.51	48	196	120	364
1925	39.9	11.4	51.3	77.9	11,290	57,587	429	74.5	68.8	5.12	52	211	143	402
1926	44.4	12.5	56.9	78.0	11,716	52,558	978	82.9	68.6	5.41	57	251	157	466
1927	43.9	7.2	51.1	85.9	12,475	49,795	289	74.4	68.6	5.13	30	232	160	425
1928	48.3	4.5	52.8	91.5	12,544	41,288	145	77.2	68.4	4.79	16	237	177	430
1929	53.4	6.5	59.9	89.2	12,649	30,082	408	86.8	69.0	4.66	23	256	192	471

[1] No accurate data on the value of the by-products available.

MONTHLY AND WEEKLY PRODUCTION

Figures for monthly and weekly production of coke are given in Tables 8 to 11. The monthly statistics of by-product coke are based upon reports from the producers themselves.

The current statistics of beehive coke are estimates based upon reports of cars of coke loaded for shipment by the principal coke-carrying roads. The reports are now received weekly and are here shown adjusted to a monthly basis. As beehive coke ordinarily is not stored at the ovens in any great quantity, the shipments are an excellent indicator of weekly production. Similar reports on a monthly basis, of shipments over the Monongahela River, are reported by the United States Engineer Office. The estimates also allow for shipments over private railroads and for amounts consumed by associated steelworks close to the ovens.

The estimates thus obtained are published currently in the weekly coal reports of the Bureau of Mines. At the end of the year, if the total of the current estimates does not exactly equal the actual production as reported to the bureau by the operators an adjustment in the current figures is made. The data in the accompanying tables have been revised in this way.

TABLE 8.—*By-product, beehive, and total coke produced in the United States, 1926–1929, by months, and average per day, in net tons*

Month	1926		1927		1928		1929	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
By-product:								
January	3, 796, 000	122, 500	3, 706, 000	119, 500	3, 906, 000	126, 000	4, 355, 000	140, 500
February	3, 492, 000	124, 700	3, 429, 000	122, 500	3, 731, 000	128, 700	4, 084, 800	145, 900
March	3, 772, 000	121, 700	3, 876, 000	125, 000	4, 074, 000	131, 400	4, 607, 600	148, 600
April	3, 604, 000	120, 100	3, 705, 000	123, 500	3, 934, 000	131, 100	4, 451, 700	148, 400
May	3, 725, 000	120, 200	3, 785, 000	122, 100	4, 109, 000	132. 500	4, 658, 700	150, 300
June	3, 614, 000	120, 500	3, 594, 000	119, 800	3, 970, 000	132, 300	4, 504, 200	150. 200
July	3, 771, 000	121. 600	3, 655, 000	117, 900	3, 920, 000	126, 400	4, 608, 200	148, 700
August	3, 742, 000	120, 700	3, 677, 000	118, 600	4, 004, 000	129, 200	4, 637, 300	149. 600
September	3, 640. 000	121, 300	3, 601, 000	120. 000	3. 967, 000	132, 300	4, 407, 700	146, 900
October	3. 799, 000	122. 500	3, 717, 000	119, 900	4, 229, 000	136, 400	4, 604, 600	148, 500
November	3, 730. 000	124. 300	3. 497, 000	116, 600	4, 142, 000	138, 100	4, 316, 400	143, 900
December	3, 692, 000	119, 100	3. 643, 000	117, 500	4, 327, 000	139, 600	4, 175, 600	134, 700
	44, 377, 000	121, 600	43, 885, 000	120, 200	48, 313, 000	132, 000	53, 411, 800	146, 300
Beehive:								
January	1, 500, 000	57, 700	810. 000	31, 200	385. 000	14, 800	515. 500	19, 100
February	1, 524. 000	63. 500	776, 000	32, 300	400, 000	16, 000	473, 700	19, 700
March	1, 259, 000	46, 600	916, 000	33, 900	459, 000	17, 100	574, 000	22, 100
April	1, 068, 000	41, 100	802, 000	30, 800	387, 000	15, 500	503, 200	19, 300
May	964, 000	37, 100	648, 000	24, 900	386, 000	14, 300	642, 800	23, 800
June	882, 000	33, 900	596, 000	22, 900	311, 000	11, 900	648, 200	25, 900
July	856, 000	32, 900	480, 000	19, 200	280, 000	11, 200	645, 800	24, 800
August	818, 000	31, 500	500, 000	18, 500	297, 000	10, 900	604, 500	22, 400
September	892, 000	34, 300	470, 000	18, 100	322, 000	12. 800	542. 600	21, 700
October	943, 000	36, 300	431, 000	16, 600	431, 000	16, 000	505, 900	18, 800
November	935, 000	36, 000	390, 000	15, 000	427, 000	16, 400	444, 700	17, 100
December	848, 000	32, 600	388, 000	14. 900	408, 000	16, 300	371, 100	14, 800
	12, 489, 000	40, 200	7, 207. 000	23, 200	4, 493, 000	14. 400	6, 472, 000	20, 800
Total coke:								
January	5, 296, 000	180, 200	4, 516, 000	150, 700	4, 291, 000	140, 800	4, 870, 500	159, 600
February	5, 016, 000	188. 200	4, 205, 000	154, 800	4, 131, 000	144, 700	4, 558, 500	165, 600
March	5, 031, 000	168, 300	4, 792, 000	158, 900	4, 533, 000	148, 500	5, 181, 600	170, 700
April	4, 672, 000	161, 200	4, 507, 000	154. 300	4, 321, 000	146, 600	4, 954, 900	167, 700
May	4, 689, 000	157, 300	4, 433, 000	147, 000	4, 495, 000	146, 800	5, 301, 500	174, 100
June	4, 496, 000	154, 400	4, 190. 000	142. 700	4, 281, 000	144, 200	5, 152, 400	176, 100
July	4, 627, 000	154, 500	4, 135, 000	137, 100	4, 200, 000	137, 600	5, 254, 000	173, 500
August	4, 560, 000	152, 200	4, 177, 000	137, 100	4, 301, 000	140, 100	5, 241, 800	172, 000
September	4, 532, 000	155, 600	4, 071, 000	138, 100	4, 289, 000	145, 100	4, 950, 300	168, 600
October	4, 742, 000	158, 800	4, 148, 000	136, 500	4, 660. 000	152, 400	5, 110, 500	167, 300
November	4, 665. 000	160, 300	3, 887, 000	131, 600	4, 569, 000	154, 500	4, 761, 100	161, 000
December	4, 540, 000	151, 700	4, 031, 000	132, 400	4, 735, 000	155, 900	4, 546. 700	149, 500
	56, 866, 000	161, 800	51, 092, 000	143, 400	52, 806, 000	146, 400	59, 883, 800	167, 100

TABLE 9.—*Coke shipped from the Connellsville and Lower Connellsville districts, Pennsylvania, 1922–1929, by months, in net tons* [1]

Month	1922	1923	1924	1925	1926	1927	1928	1929 [2]
January	377, 003	1, 046, 630	937, 790	904, 110	1, 004, 330	570, 720	221, 200	292, 842
February	397, 537	1, 048, 425	921, 070	795, 690	934, 060	552, 150	222, 550	270, 314
March	584, 497	1, 292, 435	1, 024, 770	785, 080	856, 600	630, 990	299, 400	338, 624
April	377, 433	1, 270, 355	800, 420	583, 740	756, 170	579, 330	261, 000	324, 140
May	247, 145	1, 342, 545	504, 740	349, 400	672, 550	468, 340	218, 060	457, 792
June	276, 304	1, 306, 750	303, 370	325, 800	602, 690	401, 310	185, 570	440, 028
July	283, 472	1, 196, 660	243, 090	265, 780	555, 440	302, 280	130, 380	450, 395
August	371, 499	1, 144, 790	205, 430	414, 510	545, 850	306, 000	137, 560	419, 595
September	451, 240	1, 005, 200	263, 520	513, 590	603, 680	273, 290	145, 660	337, 974
October	628, 333	914, 800	329, 430	673, 920	642, 310	222, 280	260, 470	281, 206
November	799, 087	781, 690	451, 950	830, 460	609, 010	187, 320	269, 010	207, 520
December	872, 950	754, 060	668, 980	953, 040	559, 640	187, 690	254, 090	160, 330
	5, 666, 500	13, 104, 340	6, 654, 560	7, 395, 120	8, 342, 330	4, 681, 700	2, 604, 950	3, 980, 760

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[1] From the Connellsville Courier.

[2] Weekly shipments as reported by the Courier have been prorated on a monthly basis by the Bureau of Mines.

TABLE 10.—*Beehive coke produced in the United States in 1929, by weeks*

[Estimated from railroad shipments]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 1-5 [1]	84,700	May 18	144,600	Sept. 28	127,900
Jan. 12	114,400	May 25	149,800	Oct. 5	115,600
Jan. 19	123,900	June 1	153,100	Oct. 12	118,500
Jan. 26	117,100	June 8	156,200	Oct. 19	112,400
Feb. 2	113,100	June 15	157,000	Oct. 26	102,800
Feb. 9	109,100	June 22	153,300	Nov. 2	113,900
Feb. 16	118,500	June 29	156,200	Nov. 9	122,000
Feb. 23	120,400	July 6	140,500	Nov. 16	102,800
Mar. 2	132,100	July 13	142,400	Nov. 23	91,700
Mar. 9	134,300	July 20	145,300	Nov. 30	90,400
Mar. 16	136,300	July 27	145,800	Dec. 7	92,900
Mar. 23	134,700	Aug. 3	144,400	Dec. 14	85,200
Mar. 30	124,500	Aug. 10	136,100	Dec. 21	88,600
Apr. 6	104,900	Aug. 17	132,800	Dec. 28	77,500
Apr. 13	113,100	Aug. 24	130,600	Dec. 30-31 [2]	25,100
Apr. 20	120,400	Aug. 31	133,900		
Apr. 27	121,400	Sept. 7	130,600		6,472,000
May 4	130,000	Sept. 14	132,400		
May 11	134,300	Sept. 21	132,500		

[1] 5 days only.

[2] 2 days only.

TABLE 11.—*By-product coke produced in the United States in 1929, by months and by States, in net tons* [1]

State	January	February	March	April	May	June	July
Alabama	397,300	364,800	410,000	392,100	409,300	390,900	408,600
Colorado	50,800	45,100	50,300	45,900	45,800	43,000	49,000
Illinois	298,300	301,000	371,000	349,300	374,500	371,800	373,900
Indiana	496,800	517,000	576,600	561,200	584,500	568,000	582,300
Maryland	109,600	99,300	120,800	124,100	130,200	119,500	121,900
Massachusetts	62,800	58,200	64,600	63,900	65,400	61,900	64,300
Michigan	223,000	204,500	236,600	221,400	225,800	221,200	224,200
Minnesota	61,600	55,600	58,600	58,800	69,000	68,800	72,700
New Jersey	74,500	67,900	76,500	74,600	75,700	74,100	75,500
New York	361,100	330,200	354,500	347,700	363,900	358,200	363,600
Ohio	728,000	660,100	736,500	706,200	744,800	728,800	745,300
Pennsylvania	1,194,100	1,111,300	1,247,500	1,207,000	1,266,000	1,203,800	1,223,400
Tennessee	9,500	8,200	8,600	15,100	8,300	8,000	8,200
Utah	22,200	18,800	22,500	19,700	20,600	21,200	23,600
Washington	3,600	3,100	3,500	3,600	3,600	3,400	3,300
West Virginia	121,800	109,500	123,700	118,300	122,300	116,000	116,500
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	140,000	130,200	145,800	142,800	149,000	145,600	151,900
	4,355,000	4,084,800	4,607,600	4,451,700	4,658,700	4,504,200	4,608,200

State	August	September	October	November	December	Total
Alabama	399,100	370,000	400,900	393,000	418,000	4,754,000
Colorado	44,100	45,600	48,300	48,600	48,500	565,000
Illinois	382,700	347,400	357,200	336,600	340,400	4,204,100
Indiana	585,000	533,200	524,700	477,400	448,700	6,455,400
Maryland	123,400	111,300	114,600	111,800	106,500	1,393,000
Massachusetts	65,800	66,200	68,300	68,600	66,700	776,700
Michigan	225,400	228,200	227,900	217,400	224,400	2,680,000
Minnesota	74,500	56,900	57,100	56,000	56,400	746,000
New Jersey	76,600	74,000	77,200	74,100	76,800	897,500
New York	373,900	361,400	377,800	358,800	348,400	4,299,500
Ohio	747,500	724,000	762,700	671,000	566,200	8,521,100
Pennsylvania	1,229,300	1,181,300	1,264,000	1,192,600	1,169,000	14,489,300
Tennessee	8,200	8,200	12,100	8,600	10,300	113,300
Utah	23,300	23,500	24,500	24,400	23,600	267,900
Washington	3,500	3,300	3,500	3,100	3,400	40,900
West Virginia	123,800	121,100	124,200	120,400	113,700	1,431,300
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	151,200	152,100	159,600	154,000	154,600	1,776,800
	4,637,300	4,407,700	4,604,600	4,316,400	4,175,600	53,411,800

[1] Based upon reports from all producers.

PRODUCTION BY FURNACE AND NONFURNACE PLANTS

Tables 12 to 14 give the production of by-product coke by plants associated with iron furnaces and by other plants.

The terms "furnace" and "merchant" operators originated in the Connellsville beehive-coke trade. As the name implies, the beehive-furnace interests are those affiliated with the producers of iron and steel and whose output does not ordinarily enter the open market. In the by-product industry, however, it is not always easy to classify a particular plant. There are by-product plants financially affiliated with iron furnaces, in which the bulk of the product is nevertheless foundry and domestic coke which must be sold on the competitive market. There have been other plants—entirely independent of iron furnaces in point of ownership—that nevertheless were operated under contract to produce furnace coke exclusively for an adjacent ironworks.

A "furnace" plant is now defined as one that has for its main business the production of furnace coke and that has an assured outlet for its furnace coke either through financial affiliation with or direct ownership by an ironworks or through long-time contracts.

Under this definition the class of "other" plants includes a few plants affiliated with local iron furnaces but producing much more coke than the furnaces can absorb and therefore depending chiefly on the foundry and domestic trade or on merchant sales of furnace coke. It also includes merchant producers of furnace coke who have to sell their output on the competitive market; it includes the plants affiliated with alkali works; it includes all those operated as gas utilities; and it includes the growing number of plants that, though not public utilities, have been constructed primarily to supply city gas and that must sell their coke where they can for domestic and industrial as well as metallurgical use. Because of the miscellaneous character of this group of plants, it is thought best to designate them not as "merchant" but as "nonfurnace" or "other" plants.

The classification assigned to each plant in the country is indicated in Table 23 under the column "Type of plant." From time to time it may be necessary to change the classification of a given plant because of a change in ownership or market connections, and one such change has recently been made. Effective January 1, 1929, one of the smaller plants formerly classified as "furnace" was shifted to the "merchant" classification.

TABLE 12.—*Number and production of by-product coke plants connected with iron furnaces and of other by-product plants, 1913–1929*

Year	Number of active plants		Coke produced (net tons)		Percentage of production	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
1913	20	16	9, 277, 832	3, 436, 868	73. 0	27. 0
1914	22	15	7, 832, 950	3, 386, 993	69. 8	30. 2
1915	23	17	10, 206, 434	3, 866, 461	72. 5	27. 5
1916	28	18	14, 006, 214	5, 063, 147	73. 4	26. 6
1917	31	21	16, 607, 870	5, 831, 410	74. 0	26. 0
1918	36	24	19, 220, 342	6, 777, 238	73. 9	26. 1
1919	40	25	19, 135, 587	6, 002, 034	76. 1	23. 9
1920	42	26	24, 257, 128	6, 576, 823	78. 7	21. 3
1921	42	25	15, 878, 899	3, 870, 681	80. 4	19. 6
1922	39	25	22, 850, 186	5, 700, 359	80. 0	20. 0
1923	40	25	29, 660, 369	7, 937, 295	78. 9	21. 1
1924	42	29	26, 919, 283	7, 064, 285	79. 2	20. 8
1925	43	31	31, 494, 030	8, 418, 129	78. 9	21. 1
1926	43	35	34, 714, 462	9, 662, 124	78. 2	21. 8
1927	44	35	34, 110, 858	9, 773, 868	77. 7	22. 3
1928	46	39	38, 244, 254	10, 068, 771	79. 2	20. 8
1929	46	41	41, 224, 387	12, 187, 439	77. 2	22. 8

TABLE 13.—*Monthly and average daily production of by-product coke by plants associated with iron furnaces and by all other plants, 1927–1929, in net tons*

	1927		1928		1929	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
Monthly production:						
January	2, 879, 000	827, 000	3, 048, 000	858, 000	3, 375, 600	979, 400
February	2, 675, 000	754, 000	2, 945, 000	786, 000	3, 156, 800	928, 000
March	3, 040, 000	836, 000	3, 236, 000	838, 000	3, 586, 900	1, 020, 700
April	2, 939, 000	766, 000	3, 129, 000	805, 000	3, 458, 600	993, 100
May	3, 003, 000	782, 000	3, 289, 000	820, 000	3, 630, 100	1, 028, 600
June	2, 812, 000	782, 000	3, 157, 000	813, 000	3, 497, 400	1, 006, 800
July	2, 818, 000	837, 000	3, 122, 000	798, 000	3, 592, 900	1, 015, 300
August	2, 832, 000	845, 000	3, 199, 000	805, 000	3, 602, 000	1, 035, 300
September	2, 772, 000	829, 000	3, 133, 000	834, 000	3, 386, 700	1, 021, 000
October	2, 856, 000	861, 000	3, 346, 000	883, 000	3, 536, 500	1, 068, 100
November	2, 688, 000	809, 000	3, 257, 000	885, 000	3, 293, 100	1, 023, 300
December	2, 797, 000	846, 000	3, 383, 000	944, 000	3, 107, 800	1, 067, 800
	34, 111, 000	9, 774, 000	38, 244, 000	10, 069, 000	41, 224, 400	12, 187, 400
Average daily production:						
January	92, 900	26, 600	98, 300	27, 700	108, 900	31, 600
February	95, 600	26, 900	101, 600	27, 100	112, 800	33, 100
March	98, 000	27, 000	104, 400	27, 000	115, 700	32, 900
April	98, 000	25, 500	104, 300	26, 800	115, 300	33, 100
May	96, 900	25, 200	106, 100	26, 400	117, 100	33, 200
June	93, 700	26, 100	105, 200	27, 100	116, 600	33, 500
July	90, 900	27, 000	100, 700	25, 700	115, 900	32, 800
August	91, 300	27, 300	103, 200	26, 000	116, 200	33, 400
September	92, 400	27, 600	104, 500	27, 800	112, 900	34, 000
October	92, 100	27, 800	107, 900	28, 500	114, 100	34, 400
November	89, 600	27, 000	108, 600	29, 500	109, 800	34, 100
December	90, 200	27, 300	109, 100	30, 500	100, 300	34, 400
Average	93, 400	26, 800	104, 500	27, 500	112, 900	33, 400

TABLE 14.—*Percentage of total monthly output of by-product coke produced by plants associated with iron furnaces and by other plants, 1926–1929*

Month	1926		1927		1928		1929	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
January	78.3	21.7	77.7	22.3	78.0	22.0	77.5	22.5
February	77.1	22.9	78.0	22.0	78.9	21.1	77.3	22.7
March	78.0	22.0	78.4	21.6	79.4	20.6	77.8	22.2
April	78.4	21.6	79.3	20.7	79.5	20.5	77.7	22.3
May	78.4	21.6	79.3	20.7	80.0	20.0	77.9	22.1
June	78.3	21.7	78.2	21.8	79.5	20.5	77.6	22.4
July	79.0	21.0	77.1	22.9	79.6	20.4	78.0	22.0
August	78.7	21.3	77.0	23.0	79.9	20.1	77.7	22.3
September	78.3	21.7	77.0	23.0	79.0	21.0	76.8	23.2
October	78.2	21.8	76.8	23.2	79.1	20.9	76.8	23.2
November	78.2	21.8	76.9	23.1	78.6	21.4	76.3	23.7
December	77.7	22.3	76.8	23.2	78.2	21.8	74.4	25.6
Average	78.2	21.8	77.7	22.3	79.2	20.8	77.2	22.8

PRODUCTION BY STATES AND DISTRICTS

TABLE 15.—*Rank of States in the production of coke in 1929 and highest recorded production*

State	Rank in 1929	Net tons, 1929	Maximum production	
			Year	Net tons
Pennsylvania	1	[1] 19,856,968	1916	31,279,695
Ohio	2	[2] 8,521,132	1929	[2] 8,521,132
Indiana	3	6,455,378	1929	6,455,378
Alabama	4	4,753,967	1917	4,892,589
New York	5	4,299,470	1929	4,299,470
Illinois	6	4,204,116	1929	4,204,116
Michigan	7	2,679,971	1929	2,679,971
West Virginia	8	1,928,583	1907	4,112,896
Maryland	9	1,393,052	1929	1,393,052
New Jersey	10	897,530	1926	913,250
Massachusetts	11	776,679	1929	776,679
Minnesota	12	746,004	1918	784,065
Colorado	13	721,457	1906	1,455,905
Wisconsin	14	(3)	1918	(3)
Kentucky	15	(3)	1917	863,071
Virginia	16	314,859	1906	1,577,659
Connecticut	17	(3)	1929	(3)
Utah	18	281,994	1925	314,159
Missouri	19	(3)	1923	(3)
Tennessee	20	209,166	1902	560,006
Rhode Island	21	(3)	1923	(3)
Washington	22	66,723	1916	534,653
Georgia [4]			1891	103,057
New Mexico [4]			1918	597,072
Oklahoma [4]			[5] 1905	[5] 54,781
Kansas [4]			[5] 1902	[5] 20,902
Montana [4]			[5] 1897	[5] 67,849
Wyoming [4]			[5] 1897	[5] 24,007
Texas [4]			[5] 1897	[5] 394

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[1] A small amount of beehive coke produced in Ohio is included with Pennsylvania.

[2] By-product coke only. Beehive coke can not be shown without disclosing individual operations.

[3] Can not be shown without disclosing individual operations.

[4] 7 States which formerly produced coke have dropped out of the list of producers. Georgia produced last in 1928, New Mexico in 1926, Oklahoma in 1910, Kansas in 1912, Montana in 1911, Wyoming in 1906, Texas in 1897.

[5] Figures represent maximum year that can be published without disclosing individual operations.

TABLE 16.—*By-product and beehive coke produced, by States, 1918 and 1926–1929, in net tons*

State	1918	1926	1927	1928	1929
By-product:					
Alabama	2,634,451	4,779,986	4,364,354	4,327,324	4,753,967
Colorado	230,663	592,939	594,402	605,822	565,031
Connecticut	----------	----------	----------	(1)	(1)
Illinois	2,285,610	3,336,962	3,013,940	3,240,964	4,204,116
Indiana	3,898,215	5,990,344	5,549,762	6,094,201	6,455,378
Kentucky	517,749	(1)	(1)	(1)	(1)
Maryland	474,368	1,120,610	1,077,309	1,186,398	1,393,052
Massachusetts	556,397	573,748	744,091	687,356	776,679
Michigan	(1)	1,826,638	1,920,394	2,399,656	2,679,971
Minnesota	784,065	619,905	632,628	622,696	746,004
Missouri	(1)	(1)	(1)	(1)	(1)
New Jersey	682,148	913,250	906,321	903,177	897,530
New York	1,069,587	2,827,805	3,602,642	3,802,657	4,299,470
Ohio	5,226,334	7,547,836	7,213,619	7,786,199	8,521,132
Pennsylvania	4,586,981	11,200,624	11,061,084	13,475,349	14,489,283
Rhode Island	----------	(1)	(1)	(1)	(1)
Tennessee	124,469	118,624	122,312	113,134	113,285
Utah	----------	184,756	197,183	246,503	267,939
Washington	30,129	42,584	40.570	40,755	40,879
West Virginia	603,393	1,129,862	1,396,285	1,367,481	1,431,314
Wisconsin	(1)	(1)	(1)	(1)	(1)
Combined States	2,293,021	1,570,113	1,447,830	1,413,353	1,776,796
	25,997,580	44,376,586	43,884,726	48,313,025	53,411,826
Beehive:					
Alabama	1,717,721	(1)	----------	----------	----------
Colorado	758,784	197,179	194,184	144,200	156,426
Georgia	22,048	3,059	(1)	(1)	----------
Kentucky	301,036	147,540	(1)	(1)	----------
New Mexico	597,072	(1)	----------	----------	----------
Ohio	138,909	84,970	(1)	(1)	(2)
Oklahoma	(1)	----------	----------	----------	----------
Pennsylvania	22,136,664	10,722,352	5,716,207	3,442,006	[2] 5,367,685
Tennessee	302,637	122,410	104,808	103,791	95,881
Utah	(1)	121,475	84,865	28,097	14,055
Virginia	1,234,256	370,983	316,754	247,734	314,859
Washington	93,659	24,702	30,701	18,747	25,844
West Virginia	2,716,613	583,599	527,142	431,419	497,269
Combined States	461,393	110,682	232,756	76,809	----------
	30,480,792	12,488,951	7,207,417	4,492,803	6,472,019
Grand total	56,478,372	56,865,537	51,092,143	52,805,828	59,883,845

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[1] Included under "Combined States."

[2] A small amount of beehive coke produced in Ohio is included with Pennsylvania.

TABLE 17.—*By-product and beehive coke produced in Pennsylvania, 1928 and 1929, by districts*

[The figures of number of plants and ovens include those that were idle during the year]

District	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
		Built	Under construction				Total	Per ton
1928								
By-product:								
Eastern Pennsylvania [1]	5	749	74	2,695,181	71.5	1,926,399	$9,524,386	$4.94
Western Pennsylvania [2]	6	2,486	35	17,630,482	65.5	11,548,950	41,608,020	3.60
	11	3,235	109	20,325,663	66.3	13,475,349	51,132,406	3.79
Beehive:								
Allegheny Mountain and Allegheny Valley	6	619	--------	148,206	60.3	89,301	375,281	4.20
Connellsville	56	12,515	--------	1,408,687	66.0	930,217	3,284,814	3.53
Lower Connellsville	42	10,154	--------	2,637,833	66.6	1,757,436	5,129,489	2.92
Upper Connellsville	10	1,397	--------	408,252	60.9	248,525	996,135	4.01
Pittsburgh and other districts [3]	10	2,867	--------	663,379	62.8	416,527	1,729,647	4.15
	124	27,552	--------	5,266,357	65.4	3,442,006	11,515,366	3.35
Grand total	135	30,787	109	25,592,020	66.1	16,917,355	62,647,772	3.70
1929								
By-product:								
Eastern Pennsylvania [1]	6	864	--------	3,548,817	70.8	2,513,725	12,803,069	5.09
Western Pennsylvania [2]	7	2,556	158	18,094,742	66.2	11,975,558	42,285,734	3.53
	13	3,420	158	21,643,559	66.9	14,489,283	55,088,803	3.80
Beehive:								
Allegheny Mountain and Allegheny Valley	4	524	--------	201,726	58.2	117,477	505,225	4.30
Connellsville	46	10,056	--------	2,241,830	63.7	1,428,227	5,115,645	3.58
Lower Connellsville	32	7,882	--------	3,985,720	68.0	2,710,221	7,787,124	2.87
Upper Connellsville	9	1,322	--------	426,798	62.3	265,808	1,021,391	3.84
Pittsburgh and other districts [3]	11	3,006	--------	[4] 1,339,454	[4] 63.2	[4] 845,952	[4] 3,395,041	[4] 4.01
	102	22,790	--------	[4] 8,195,528	[4] 65.5	[4] 5,367,685	[4] 17,824,426	[4] 3.32
Grand total	115	26,210	158	[4] 29,839,087	[4] 66.5	[4] 19,856,968	[4] 72,913,229	[4] 3.67

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[1] Includes in 1928 plants at Bethlehem, Chester, Lebanon, Steelton, and Swedeland; 1929, Bethlehem, Chester, Lebanon, Philadelphia, Steelton, and Swedeland.

[2] Includes in 1928 plants at Clairton, Erie, Johnstown, Midland, Pittsburgh, and Woodlawn; 1929, Aliquippa, Clairton, Erie, Johnstown, Midland, Neville Island, and Pittsburgh.

[3] Includes Bedford, Clearfield, Huntingdon, Jefferson, and parts of Indiana and Westmoreland Counties.

[4] A small amount of coke produced in Ohio is included with Pennsylvania.

TABLE 18.—*By-product and beehive coke produced in Ohio, 1928 and 1929, by districts*

District	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
		Built	Under construction				Total	Per ton
1928								
By-product:								
Canton, Cleveland, and Massillon	5	580	15	3, 807, 300	69. 1	2, 631, 938	$11, 371, 547	$4. 32
Youngstown	3	594		3, 528, 393	64. 2	2, 264, 158	9, 225, 445	4. 07
Other districts [1]	8	646		4, 130, 351	70. 0	2, 890, 103	13, 311, 871	4. 61
	16	1, 820	15	11, 466, 044	67. 9	7, 786, 199	33, 908, 863	4. 35
Beehive	1	202		(2)	(2)	(2)	(2)	(2)
Grand total	17	2, 022	15	(2)	(2)	(2)	(2)	(2)
1929								
By-product:								
Canton, Cleveland, and Massillon	5	595		3, 963, 934	70. 5	2, 794, 431	10, 900, 017	3. 90
Youngstown	3	594		3, 808, 797	65. 4	2, 491, 956	10, 050, 899	4. 03
Other districts [1]	7	622		4, 543, 955	71. 2	3, 234, 745	14, 251, 467	4. 41
	15	1, 811		12, 316, 686	69. 2	8, 521, 132	35, 202, 383	4. 13
Beehive	1	202		(2)	(2)	(2)	(2)	(2)
Grand total	16	2, 013		(2)	(2)	(2)	(2)	(2)

[1] Includes in 1928 plants at Dover, Hamilton, Ironton, Lorain, Painesville, Portsmouth, Toledo, and Warren; 1929, Hamilton, Ironton, Lorain, Painesville, Portsmouth, Toledo, and Warren.
[2] Not at liberty to publish—1929 figures included with Pennsylvania. See Table 17.

TABLE 19.—*By-product and beehive coke produced in West Virginia, 1928 and 1929, by districts*

[The figures of number of plants and ovens include those that were idle during the year]

District	Plants	Ovens in existence [1]	Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
1928							
By-product: Fairmont, Benwood, Follansbee, and Weirton	4	[2] 411	1, 966, 364	69. 5	1, 367, 481	$3, 761, 460	$2. 75
Beehive:							
Flat Top	8	1, 351	164, 228	57. 0	93, 556	378, 310	4. 04
Kanawha, Upper Monongahela, and Panhandle	18	1, 955	357, 966	60. 9	217, 914	655, 955	3. 01
New River	7	700	200, 485	56. 6	113, 495	489, 965	4. 32
Upper Potomac and Tygarts Valley	7	402	10, 825	59. 6	6, 454	19, 703	3. 05
	40	4, 408	733, 504	58. 8	431, 419	1, 543, 933	3. 58
Grand total	44	4, 819	2, 699, 868	66. 6	1, 798, 900	5, 305, 393	2. 95
1929							
By-product: Fairmont, Benwood, Follansbee, and Weirton	4	[2] 411	2, 056, 475	69. 6	1, 431, 314	3, 610, 883	2. 52
Beehive:							
Flat Top	4	795	28, 813	62. 5	18, 008	64, 820	3. 60
Kanawha, Upper Monongahela, and Panhandle	10	1, 324	599, 170	59. 8	358, 006	1, 104, 822	3. 09
New River	6	659	209, 033	57. 4	119, 989	500, 256	4. 17
Upper Potomac and Tygarts Valley	3	160	2, 126	59. 5	1, 266	5, 646	4. 46
	23	2, 938	839, 142	59. 3	497, 269	1, 675, 544	3. 37
Grand total	27	3, 349	2, 895, 617	66. 6	1, 928, 583	5, 286, 427	2. 74

[1] No ovens under construction at end of year.
[2] Includes 291 Koppers and 120 Semet-Solvay ovens.

NUMBER AND TYPE OF OVENS

Tables 20 to 25 show the number and location of different types of coke ovens. Table 23 gives a complete list of the by-product plants by name. For similar data for beehive coke the reader is referred to a list on pages 611 to 613 of Coke and By-Products in 1926, which gives the name, location, and number of ovens at 182 beehive coke plants that were active in 1926.

Because of the gradual replacement of beehive with by-product coke large numbers of beehive ovens in the country have produced no coke for years and are falling into disrepair. It has been the practice of the Bureau of Mines to retain such batteries of ovens on its lists until notified by the operator that they were definitely abandoned. With the passage of time it became clear that many of the ovens listed could not be used again without very extensive repairs, and in 1929 the following inquiry was sent to the owners of plants that had produced no coke for five years or more: "Please state whether in your opinion this plant will ever be operated again as it stands, or with minor repairs." The replies indicated that a considerable number of plants hitherto carried on the lists as idle could be considered as abandoned. As a result, the number of beehive ovens counted as "abandoned during the year" was unusually high—11,611 as against 8,299 in 1928 (Table 22). The increase in number abandoned over 1928 is thus more apparent than real.

TABLE 20.—*By-product coke ovens built and under construction at end of each year, by States, 1926–1929*

State	1926		1927		1928		1929	
	Built	Under construction	Built	Under construction	Built	Under construction	Built	Under construction
Alabama	1,276	112	1,325	63	1,388	--------	1,388	--------
Colorado	120	--------	120	--------	120	--------	120	--------
Connecticut	--------	--------	--------	61	61	--------	61	--------
Illinois	849	--------	849	101	937	21	905	45
Indiana	1,394	40	1,384	--------	1,384	--------	1,498	--------
Kentucky	108	--------	108	--------	108	--------	108	--------
Maryland	300	60	360	--------	360	--------	300	61
Massachusetts	466	15	481	--------	381	--------	381	82
Michigan	420	120	561	--------	576	--------	576	--------
Minnesota	220	--------	215	41	196	--------	196	--------
Missouri	64	--------	64	--------	64	--------	64	--------
New Jersey	207	--------	207	--------	207	--------	207	--------
New York	661	[1] 117	778	--------	868	--------	868	37
Ohio	1,689	89	1,778	--------	1,820	15	1,811	--------
Pennsylvania	3,126	425	3,429	--------	3,235	109	3,420	158
Rhode Island	40	--------	40	--------	40	--------	40	25
Tennessee	24	--------	24	--------	24	--------	24	--------
Utah	33	--------	33	23	56	--------	56	--------
Washington	20	--------	20	--------	20	--------	20	--------
West Virginia	411	--------	411	--------	411	--------	411	--------
Wisconsin	288	--------	288	--------	288	--------	195	--------
	11,716	[1] 978	12,475	289	12,544	145	12,649	408

[1] Includes information published in Iron Age, Jan. 20, 1927, p. 257, as to ovens under construction at plant.

TABLE 21.—*Beehive coke ovens at end of each year, by States, 1924–1929*

State	1924	1925	1926	1927	1928	1929 [1]
Alabama	6,199	4,961	1,831	1,831	953	
Colorado	1,696	1,681	1,527	1,498	1,498	378
Georgia	151	151	151	151		
Kentucky	795	795	763	763	608	200
New Mexico	1,030	1,030	584	584	584	
Ohio	205	204	204	204	202	202
Oklahoma	300	300	300	100	100	100
Pennsylvania	36,030	34,668	34,375	32,135	27,552	22,790
Tennessee	1,555	1,675	1,605	1,465	1,415	723
Utah	819	819	819	819	819	819
Virginia	3,234	3,124	2,914	3,014	2,914	1,742
Washington	408	332	332	332	235	190
West Virginia	8,010	7,847	7,153	6,899	4,408	2,938
	60,432	57,587	52,558	49,795	41,288	30,082

[1] The unusually large reduction in number of beehive ovens in 1929 was partly due to a change in the form of inquiry. (See text.)

TABLE 22.—*Coke ovens completed and abandoned in 1928 and 1929 and total number in existence and under construction at end of year, by States*

State	Plants in existence	Ovens						
		New [1]		Abandoned during year	In existence Dec. 31		Under construction Dec. 31	
		Number	Capacity per day (net tons of coke)		Number	Capacity per day (net tons of coke)	Number	Capacity per day (net tons of coke)
1928								
By-product:								
Alabama	8	63	1,305		1,388	16,467		
Colorado	1				120	1,700		
Connecticut	1	61	858		61	858		
Illinois	8	101	1,600	13	937	13,120	21	160
Indiana	7				1,384	19,287		
Kentucky	1				108	(2)		
Maryland	1				360	5,085		
Massachusetts	3			100	381	2,387		
Michigan	7				576	7,607		
Minnesota	3	46	790	65	196	[3] 2,562		
Missouri	1				64	(2)		
New Jersey	2				207	2,531		
New York	9	90	900		868	12,687		
Ohio	16	45	794	3	1,820	[3] 25,052	15	135
Pennsylvania	11			194	3,235	42,476	109	1,805
Rhode Island	1				40	(2)		
Tennessee	1				24	365		
Utah	1	23	415		56	1,015		
Washington	1				20	111		
West Virginia	4				411	4,623		
Wisconsin	2				288	(2)		
Undistributed						5,470		
	89	429	6,662	375	12,544	[3] 163,403	145	2,100
Beehive:								
Alabama	6			878	953	(4)		
Colorado	5				1,498			
Georgia				151				
Kentucky	2				608			
New Mexico	2				584			
Ohio	1			2	202			
Oklahoma	1				100			
Pennsylvania	124			4,622	27,552			
Tennessee	7			50	1,415			
Utah	1				819			
Virginia	12			100	2,914			
Washington	3			97	235			
West Virginia	40			2,399	4,408			
	204			8,299	41,288	(4)		

[1] Represents new construction. Does not include ovens repaired and put into commission.
[2] Included under "Undistributed."
[3] Revised since last report.
[4] Data not available.

TABLE 22.—*Coke ovens completed and abandoned in 1928 and 1929 and total number in existence and under construction at end of year, by States*—Contd.

State	Plants in existence	Ovens: New, Number	Ovens: New, Capacity per day (net tons of coke)	Ovens: Abandoned during year	Ovens: In existence Dec. 31, Number	Ovens: In existence Dec. 31, Capacity per day (net tons of coke)	Ovens: Under construction Dec. 31, Number	Ovens: Under construction Dec. 31, Capacity per day (net tons of coke)
1929								
By-product:								
Alabama	8				1,388	16,412		
Colorado	1				120	1,700		
Connecticut	1				61	(2)		
Illinois	8	21	150	53	905	13,265	45	650
Indiana	7	114	1,446		1,498	20,451		
Kentucky	1				108	(2)		
Maryland	1			60	300	4,140	61	848
Massachusetts	3				381	2,369	82	1,856
Michigan	7				576	7,607		
Minnesota	3				196	2,562		
Missouri	1				64	(2)		
New Jersey	2				207	2,525		
New York	9				868	12,419	37	350
Ohio	15	15	101	24	1,811	25,204		
Pennsylvania	13	185	3,135		3,420	44,170	158	2,671
Rhode Island	1				40	(2)	25	400
Tennessee	1				24	350		
Utah	1				56	1,015		
Washington	1				20	123		
West Virginia	4				411	4,819		
Wisconsin	2	15	84	108	195	(2)		
Undistributed						5,709		
	90	350	4,916	245	12,649	164,840	408	6,775
At merchant plants	43	150	2,029	53	3,408	39,024	144	2,606
At furnace plants	47	200	2,887	192	9,241	125,816	264	4,169
Beehive:								
Alabama				953		(4)		
Colorado	2			1,120	378			
Kentucky	1			408	200			
New Mexico				584				
Ohio	1				202			
Oklahoma	1				100			
Pennsylvania	102			5,066	22,790			
Tennessee	4			692	723			
Utah	1				819			
Virginia	9			1,172	1,742			
Washington	2			45	190			
West Virginia	23			1,571	2,938			
	146			[5] 11,611	30,082	(4)		

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[2] Included under "Undistributed."

[4] Data not available.

[5] See Table 21, note 1, and text.

TABLE 23.—*List of by-product coke plants in the United States, December 31, 1929*

State	Town	Name of company operating plant	Type of plant [1]	Number of ovens	Type of oven	Year put in operation [2]
Alabama	Alabama City	Gulf States Steel Co	F	37	Koppers	1916
	Ensley	Semet-Solvay Co	M	240	Semet-Solvay	1898–1902
	Fairfield	Tennessee Coal, Iron & R. R. Co.	F	497	Koppers	1912–1928
	North Birmingham.	Sloss-Sheffield Steel & Iron Co.	F	120	Semet-Solvay	1920
	Tarrant	Alabama By-Products Corporation.	M	149	Koppers	1920–1927
	Thomas	Republic Iron & Steel Co	F	57	do	1925
	Tuscaloosa	Central Iron & Coal Co	F	60	Semet-Solvay	1906–1914
	Woodward	Woodward Iron Co	F	168	Koppers	1911–1914
	do	do	F	60	Wilputte	1917
Colorado	Pueblo	Colorado Fuel & Iron Co	F	120	Koppers	1918
Connecticut	New Haven	Connecticut Coke Co	M	61	do	1928
Illinois	Chicago	Interlake Iron Corporation	M	120	Semet-Solvay	1905–1915
	do	do	M	110	Koppers	1925
	do	Peoples Gas Light & Coke Co.	M	105	do	1921–22
	Granite City	St. Louis Gas & Coke Corporation.	F	80	Roberts	1921
	Joliet	Illinois Steel Co	F	280	Koppers	1908-9
	Rockford	Rockford Gas Light & Coke Co.	M	21	do	1929
	South Chicago	Wisconsin Steel Works	F	88	Wilputte	1919
	do	Youngstown Sheet & Tube Co.	F	70	Koppers	1928
	Waukegan	North Shore Coke & Chemical Co.	M	31	do	1928
Indiana	Fort Wayne	Northern Indiana Public Service Co.	M	19	do	1925
	Gary	Illinois Steel Co	F	838	do	1911–1926
	Indiana Harbor	Inland Steel Co	F	278	do	1913–1929
	do	Youngstown Sheet & Tube Co.	F	120	Semet-Solvay	1919
	Indianapolis	Citizens Gas Co	M	41	do	1913
	do	do	M	120	Wilputte	1918–1929
	Muncie	Central Indiana Gas Co	M	22	Klönne	1912
	Terre Haute	Indiana Consumers Gas & By-Products Co.	M	60	Koppers	1919–1926
Kentucky	Ashland	Ashland By-Product Coke Co.	M	108	Semet-Solvay	1913–1916
Maryland	Sparrows Point	Bethlehem Steel Co	F	300	Koppers	1914–1927
Massachusetts	Everett	New England Fuel & Transportation Co.	M	300	United-Otto	1899
	do	do	M	55	Wilputte	1926
	Framingham	West Boston Gas Co	M	15	Koppers	1927
	Lynn	Lynn Gas & Elec. Co	M	11	do	1925
Michigan	Battle Creek	Battle Creek Gas Co	M	18	do	1924–1927
	Detroit	Semet-Solvay Co	M	216	Semet-Solvay	1901–1917
	Flint	Consumers Power Co	M	29	Koppers	1927
	Fordson	Ford Motor Co	F	120	Semet-Solvay	1919
	do	do	F	120	Wilputte	1927
	Jackson	Consumers Power Co	M	15	Koppers	1925
	Wyandotte	Michigan Alkali Co	M	39	do	1927
	Zilwaukee	Consumers Power Co	M	19	do	1924
Minnesota	Duluth	Minnesota Steel Co	F	90	do	1915–16
	St. Paul	Minnesota By-Product Coke Co.	M	65	do	1918–1928
	West Duluth	Interlake Iron Corporation.	F	41	do	1928
Missouri	St. Louis	Laclede Gas Light Co	M	56	do	1915
	do	do	M	8	Piette	1921
New Jersey	Camden	Camden Coke Co	M	37	Koppers	1921
	Kearny	Seaboard By-Product Coke Co.	M	170	do	1917–1925
New York	Buffalo	Donner-Hanna Coke Corporation.	F	150	do	1920
	do	Semet-Solvay Co	M	120	Semet-Solvay	1917–1927
	Geneva	Empire Gas & Electric Co	M	46	do	1904–1909
	Greenpoint	Brooklyn Union Gas Co	M	90	Koppers	1928
	Hunts Point	Consolidated Gas Co	M	74	do	1926
	Lackawanna	Bethlehem Steel Co	F	60	Semet-Solvay	1920
	do	do	F	171	Koppers	1924–1927
	Rochester	Rochester Gas & Electric Co.	M	60	do	1926

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[1] F, "Furnace plants," or plants associated with iron furnaces and steelworks. M, "Nonfurnace plants," or "Other plants" (see Tables 12–14), including merchant plants, plants associated with industries other than iron and steel, and plants supplying gas under contract for city use. Since the publication of the report for 1925 changes in classification of certain plants have been made to conform with changes in definition of what constitutes a furnace plant.

[2] The first and last years are given for those plants that have 2 or more installations.

TABLE 23.—*List of by-product coke plants in the United States, December 31, 1929*—Continued

State	Town	Name of company operating plant	Type of plant	Number of ovens	Type of oven	Year put in operation
New York	Troy	Hudson Valley Coke & Products Corporation.	M	55	American-Foundation.	1925
	Utica	Utica Gas & Electric Co.	M	42	Koppers	1924–1926
Ohio	Campbell	Youngstown Sheet & Tube Co.	F	306	do	1916–1918
	Canton	Central Alloy Steel Corporation.	F	62	do	1916–1929
	Cleveland	American Steel & Wire Co.	F	180	do	1918
	do	Corrigan-McKinney Steel Co.	F	204	do	1916
	do	Otis Steel Co.	F	100	Semet-Solvay	1910–1913
	Hamilton	Hamilton Coke & Iron Co.	F	45	Koppers	1928
	Ironton	Ironton By-Product Coke Co.	M	60	Semet-Solvay	1918
	Lorain	National Tube Co.	F	208	Koppers	1918
	Massillon	Central Alloy Steel Corporation.	F	49	do	1927
	Painesville	Diamond Alkali Co.	M	43	do	1924–1927
	Portsmouth	Portsmouth By-Product Coke Co.	F	108	Semet-Solvay	1917
	Toledo	Interlake Iron Corporation	F	94	Koppers	1916
	Warren	Trumbull-Cliffs Furnace Co.	F	64	do	1924–1927
	Youngstown	Republic Iron & Steel Co.	F	204	do	1914–1926
	do	Youngstown Sheet & Tube Co.	F	84	do	1917
Pennsylvania	Aliquippa	Jones & Laughlin Steel Co.	F	122	do	1926
	Bethlehem	Bethlehem Steel Co.	F	424	do	1918
	Chester	Philadelphia Electric Co.	M	25	Roberts-Morrissey.	1925
	Clairton	Carnegie Steel Co.	F	1,482	Koppers	1918–1927
	Erie	Interlake Iron Corporation	F	37	Wilputte	1925
	Johnstown	Bethlehem Steel Co.	F	127	Koppers	1915–1927
	do	do	F	170	Cambria	1906–1920
	do	do	F	88	Semet-Solvay	1921
	Lebanon	do	F	90	do	1904–1921
	Midland	Pittsburgh Crucible Steel Co.	F	100	Koppers	1920
	Neville Island	Davison Coke & Iron Co.	F	70	do	1929
	Philadelphia	Philadelphia Coke Co.	M	74	do	1929
	Pittsburgh	Jones & Laughlin Steel Co.	F	300	do	1919–20
	do	do	F	60	Wilputte	1926
	Steelton	Bethlehem Steel Co.	F	40	Semet-Solvay	1907
	do	do	F	60	Koppers	1919
	Swedeland	Rainey-Wood Coke Co.	F	151	do	1919–1929
Rhode Island	Providence	Providence Gas Co.	M	40	do	1919
Tennessee	Altonpark	Tennessee Products Corporation.	M	24	Semet-Solvay	1915
Utah	Provo	Columbia Steel Corporation.	F	56	Koppers	1924–1928
Washington	Seattle	Seattle Lighting Co.	M	20	Klönne	1914
West Virginia	Benwood	National Tube Co.	M	120	Semet-Solvay	1898–1901
	East Steubenville.	Wheeling Steel Corporation.	F	145	Koppers	1917–1926
	Fairmont	Domestic Coke Corporation.	M	60	do	1920
	Weirton	Weirton Steel Co.	F	86	do	1923–1926
Wisconsin	Milwaukee	Milwaukee Coke & Gas Co.	M	80	Semet-Solvay	1901–1906
	do	do	M	100	Koppers	1921–22
	Sheyboygan	Wisconsin Public Service Co.	M	15	do	1929

TABLE 24.—*List of by-product ovens under construction in the United States, December 31, 1929*

State	Town	Name of company operating plant	Number of ovens	Type of oven	Date of operation
Illinois	South Chicago	Wisconsin Steel Works	45	Wilputte	1931.
Maryland	Sparrows Point	Bethlehem Steel Co	61	Koppers	September, 1930.
Massachusetts	Everett	New England Fuel & Transportation Co.	82	do	July, 1930.
New York	Rochester	Rochester Gas & Electric Co.	37	do	April, 1930.
Pennsylvania	Johnstown	Bethlehem Steel Co	77	do	Do.
	Aliquippa	Jones & Laughlin Steel Co	81	do	May, 1930.
Rhode Island	Providence	Providence Gas Co	25	do	January, 1930.

TABLE 25.—*By-product ovens of each type at the end of the year, by States, in 1929*

State	Koppers [1]	Semet-Solvay	Wilputte	United Otto [2]	Cambria-Belgian	Roberts [3]	American-Foundation	Klönne	Piette	Total
Alabama	908	420	60							1,388
Colorado	120									120
Connecticut	61									61
Illinois	617	120	88			80				905
Indiana	1,195	161	120					22		1,498
Kentucky		108								108
Maryland	300									300
Massachusetts	26		55	300						381
Michigan	120	336	120							576
Minnesota	196									196
Missouri	56								8	64
New Jersey	207									207
New York	587	226					55			868
Ohio	1,543	268								1,811
Pennsylvania	2,910	218	97		170	25				3,420
Rhode Island	40									40
Tennessee		24								24
Utah	56									56
Washington								20		20
West Virginia	291	120								411
Wisconsin	115	80								195
	9,348	2,081	540	300	170	105	55	42	8	12,649

[1] Includes the Koppers-Becker type.
[2] Includes the Otto-Hoffman and Schniewind types.
[3] Includes the Roberts-Morrissey type.

CAPACITY OF BY-PRODUCT OVENS

TABLE 26.—*Estimated annual potential production of coke and coal required for charge of by-product coke ovens in the United States, 1927–1929, when operated at different percentages of maximum capacity, in millions of net tons*

Percentage of maximum capacity	1927				1928 [1]				1929			
	Ovens completed Dec. 31		Including ovens under construction		Ovens completed Dec. 31		Including ovens under construction		Ovens completed Dec. 31		Including ovens under construction	
	Coke	Coal [2]	Coke	Coal [2]	Coke	Coal [2]	Coke	Coal [2]	Coke	Coal [2]	Coke	Coal [2]
100	57.9	82.7	59.5	85.0	59.6	85.1	60.4	86.3	60.2	86.0	62.6	89.4
90	52.1	74.4	53.6	76.5	53.6	76.6	54.4	77.7	54.2	77.4	56.3	80.5
85	49.2	70.3	50.6	72.3	50.7	72.3	51.3	73.4	51.2	73.1	53.2	76.0
75	43.4	62.0	44.6	63.8	44.7	63.8	45.3	64.7	45.2	64.5	47.0	67.1
50	29.0	41.4	29.8	42.5	29.8	42.6	30.2	43.2	30.1	43.0	31.3	44.7

[1] Revised since last report.
[2] Coal for charge estimated on basis of 70 per cent yield in coke.

TABLE 27.—*Relation (per cent) of production to maximum capacity at by-product coke plants, 1924–1929, by months*

	1924	1925	1926	1927	1928	1929		1924	1925	1926	1927	1928	1929
January	81.4	86.0	94.6	84.5	80.4	88.6	August	61.1	77.8	88.3	79.8	82.8	93.6
February	83.8	86.0	96.4	85.4	82.2	91.3	September	65.7	80.9	88.7	80.8	84.3	91.9
March	84.8	85.7	93.8	87.2	83.2	93.0	October	71.7	82.0	88.5	76.4	86.3	92.3
April	81.4	84.9	89.5	84.8	82.6	92.8	November	74.8	88.5	88.9	74.2	86.8	89.0
May	73.1	80.9	89.0	83.9	83.5	94.0	December	80.8	90.6	84.7	74.6	87.8	83.1
June	65.3	80.3	88.4	82.3	83.2	93.9							
July	59.2	78.0	89.3	79.3	81.0	93.0	The year	73.4	83.5	89.9	80.9	83.7	91.4

QUANTITY AND COST OF COAL CHARGED

Although the quantity of coal used in the manufacture of coke has been increasing at a rapid rate during the past 30 years (Coke and By-Products in 1925, p. 558), the proportion of the total output of bituminous coal carbonized each year has remained remarkably constant, ranging from 12 to about 16 per cent. In 1929 the coke ovens in the United States consumed 86,786,474 tons, 16.2 per cent of the total output of bituminous coal. (See Table 28.) Of this amount 76,758,958 tons was used in the by-product ovens.

Increasing interest in the marketing of coal has led to a demand for current figures of the quantity of coal required by the major industries from month to month. Statistics of the quantity charged in by-product coke ovens therefore have been published by the bureau monthly since March, 1929, in the Current Trend of Consumption Analysis, issued as an appendix to the Weekly Coal Report. A background to this current analysis is afforded by Table 29.

TABLE 28.—*Coal used in manufacture of coke in the United States, 1918–1929, in net tons*

[For comparable figures back to 1880 see Coke and By-Products in 1925, p. 558]

Year	By-product	Beehive	Total	Year	By-product	Beehive	Total
1918	36,867,721	48,160,297	85,028,018	1924	49,061,339	15,914,310	64,975,649
1919	35,857,419	29,730,499	65,587,918	1925	57,109,651	17,422,581	74,532,232
1920	44,204,996	31,985,836	76,190,832	1926	63,646,610	19,224,500	82,871,110
1921	28,713,111	8,475,446	37,188,557	1927	63,239,773	11,208,115	74,447,888
1922	41,052,670	13,285,868	54,338,538	1928	70,165,906	7,017,974	77,183,880
1923	54,275,577	30,084,366	84,359,943	1929	76,758,958	10,027,516	86,786,474

TABLE 29.—*Coal consumed in coke ovens, 1927–1929, by months, in net tons*

[For figures 1912 to 1926, inclusive, see Coke and By-Products in 1928, pp. 731–732]

Month	1927			1928			1929		
	By-product	Beehive	Total	By-product	Beehive	Total	By-product	Beehive	Total
January	5,341,000	1,260,000	6,601,000	5,673,000	601,000	6,274,000	6,250,200	798,600	7,048,800
February	4,941,000	1,207,000	6,148,000	5,419,000	625,000	6,044,000	5,870,200	734,300	6,604,500
March	5,586,000	1,424,000	7,010,000	5,917,000	717,000	6,634,000	6,621,200	889,800	7,511,000
April	5,339,000	1,247,000	6,586,000	5,713,000	605,000	6,318,000	6,395,400	779,300	7,174,700
May	5,454,000	1,008,000	6,462,000	5,968,000	603,000	6,571,000	6,693,900	995,900	7,689,800
June	5,179,000	927,000	6,106,000	5,766,000	486,000	6,252,000	6,471,000	1,004,500	7,475,500
July	5,267,000	746,000	6,013,000	5,693,000	437,000	6,130,000	6,620,300	1,000,200	7,620,500
August	5,299,000	778,000	6,077,000	5,815,000	464,000	6,279,000	6,662,000	936,900	7,598,900
September	5,189,000	731,000	5,920,000	5,761,000	503,000	6,264,000	6,335,700	840,500	7,176,200
October	5,356,000	670,000	6,026,000	6,142,000	673,000	6,815,000	6,623,200	783,600	7,406,800
November	5,039,000	607,000	5,646,000	6,015,000	667,000	6,682,000	6,208,400	689,300	6,897,700
December	5,250,000	603,000	5,853,000	6,284,000	637,000	6,921,000	6,007,500	574,600	6,582,100
	63,240,000	11,208,000	74,448,000	70,166,000	7,018,000	77,184,000	76,759,000	10,027,500	86,786,500

TABLE 30.—*Total quantity and value at ovens of coal used in the manufacture of coke, by States, 1928 and 1929*

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Per ton of coal	Net tons	Cost
1928					
By-product plants:					
Alabama	6, 215, 804	$16, 316, 220	$2. 62	1. 44	$3. 77
Colorado	891, 315	(1)	(1)	1. 47	------
Illinois	4, 712, 289	20, 278, 587	4. 30	1. 45	6. 24
Indiana	8, 202, 943	38, 983, 679	4. 75	1. 35	6. 41
Maryland	1, 635, 668	(1)	(1)	1. 38	------
Massachusetts	1, 035, 336	5, 030, 773	4. 86	1. 51	7. 34
Michigan	3, 397, 164	14, 829, 539	4. 37	1. 42	6. 21
Minnesota	899, 938	4, 782, 844	5. 31	1. 45	7. 70
New Jersey	1, 252, 990	(1)	(1)	1. 39	------
New York	5, 501, 162	23, 803, 437	4. 33	1. 45	6. 28
Ohio	11, 466, 044	39, 376, 695	3. 43	1. 47	5. 04
Pennsylvania	20, 325, 663	56, 354, 542	2. 77	1. 51	4. 18
Tennessee	151, 424	471, 686	3. 12	1. 34	4. 18
Utah	448, 350	(1)	(1)	1. 82	------
Washington	64, 458	340, 163	5. 28	1. 58	8. 34
West Virginia	1, 966, 364	5, 059, 164	2. 57	1. 44	3. 70
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1, 998, 994	7, 745, 241	3. 87	1. 41	5. 46
Undistributed	------------	17, 233, 718	4. 08	--------	------
	70, 165, 906	250, 606, 288	3. 57	1. 45	5. 18
Beehive plants:					
Colorado	220, 515	(1)	(1)	1. 53	------
Pennsylvania	5, 266, 357	9, 701, 498	1. 84	1. 53	2. 82
Tennessee	173, 706	371, 747	2. 14	1. 67	3. 57
Utah	48, 675	(1)	(1)	1. 73	------
Virginia	420, 765	681, 827	1. 62	1. 70	2. 75
Washington	29, 353	130, 034	4. 30	1. 57	6. 75
West Virginia	733, 504	1, 098, 076	1. 50	1. 70	2. 55
Georgia, Kentucky, and Ohio	125, 099	315, 162	2. 52	1. 63	4. 11
Undistributed	------------	862, 797	3. 21	--------	------
	7, 017, 974	13, 161, 141	1. 88	1. 56	2. 93
1929					
By-product plants:					
Alabama	6, 708, 774	16, 679, 293	2. 49	1. 41	3. 51
Colorado	830, 748	(1)	(1)	1. 47	------
Illinois	5, 984, 119	25, 653, 161	4. 29	1. 42	6. 09
Indiana	8, 748, 928	40, 330, 893	4. 61	1. 36	6. 27
Maryland	1, 914, 048	(1)	(1)	1. 37	------
Massachusetts	1, 126, 370	5, 292, 465	4. 70	1. 45	6. 82
Michigan	3, 760, 441	16, 142, 910	4. 29	1. 40	6. 01
Minnesota	1, 062, 179	5, 354, 154	5. 04	1. 42	7. 16
New Jersey	1, 248, 662	(1)	(1)	1. 39	------
New York	6, 183, 918	26, 090, 898	4. 22	1. 44	6. 08
Ohio	12, 316, 686	40, 742, 493	3. 31	1. 45	4. 80
Pennsylvania	21, 643, 559	59, 014, 912	2. 73	1. 49	4. 07
Tennessee	160, 842	485, 027	3. 02	1. 42	4. 29
Utah	493, 945	(1)	(1)	1. 84	------
Washington	65, 845	346, 170	5. 26	1. 61	8. 47
West Virginia	2, 056, 475	4, 946, 851	2. 41	1. 44	3. 47
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2, 453, 419	9, 505, 625	3. 87	1. 38	5. 34
Undistributed	------------	18, 347, 408	4. 09	--------	------
	76, 758, 958	268, 932, 261	3. 50	1. 44	5. 04
Beehive plants:					
Colorado	237, 926	(1)	(1)	1. 52	------
Ohio and Pennsylvania	8, 195, 528	15, 065, 398	1. 84	1. 53	2. 82
Tennessee	169, 385	319, 977	1. 89	1. 77	3. 35
Utah	23, 361	(1)	(1)	1. 66	------
Virginia	527, 280	888, 761	1. 69	1. 67	2. 82
Washington	34, 894	157, 021	4. 50	1. 35	6. 08
West Virginia	839, 142	1, 246, 705	1. 49	1. 69	2. 52
Undistributed	------------	738, 478	2. 83	--------	------
	10, 027, 516	18, 416, 340	1. 84	1. 55	2. 85

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[1] Included under "Undistributed."

TABLE 31.—*Average cost per net ton of coal charged into by-product coke ovens, by States, 1919–1929*

State	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Alabama	$3.35	$4.10	$3.29	$2.47	$2.95	$2.85	$2.68	$2.65	$2.64	$2.62	$2.49
Illinois	4.73	6.49	5.90	5.92	5.78	5.16	4.89	4.75	4.67	4.30	4.29
Indiana	4.63	5.92	5.89	5.70	5.77	5.23	5.03	5.00	5.05	4.75	4.61
Kentucky	3.40	4.84	4.20	4.28	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Massachusetts	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	4.92	4.86	4.70
Michigan	4.60	7.03	5.77	5.65	5.79	5.34	4.76	4.75	4.70	4.37	4.29
Minnesota	4.33	6.50	7.12	6.79	6.74	5.89	5.33	5.33	5.48	5.31	5.04
New York	4.34	6.20	5.86	5.60	5.31	4.75	4.51	4.60	4.71	4.33	4.22
Ohio	3.85	5.75	4.94	5.04	4.84	4.04	3.82	3.86	3.88	3.43	3.31
Pennsylvania	2.99	3.91	3.39	3.78	3.77	3.19	2.97	2.97	2.95	2.77	2.73
Tennessee	3.64	4.30	3.84	3.84	3.50	3.33	3.00	3.02	3.31	3.12	3.02
Washington	5.89	6.63	6.53	5.50	5.44	5.39	5.32	5.32	5.21	5.28	5.26
West Virginia	3.18	4.82	3.89	4.07	4.03	3.82	3.06	3.07	2.84	2.57	2.41
Average	3.96	5.40	4.84	4.73	4.76	4.13	3.86	3.88	3.87	3.57	3.50
Cost of coal per ton of coke	5.65	7.73	7.03	6.81	6.85	5.95	5.52	5.55	5.57	5.18	5.04

[1] Not at liberty to publish.

Table 32 and Figure 22 trace the relative values of the coke and the by-products and the cost of coking coal, all reckoned per ton of coke produced. Thus in 1913 the average value of by-product coke was $3.83, the value of the by-products per ton of coke was $1.41, and the cost of coal per ton of coke was $3.27. In 1929 the value of the coke had risen to $4.80 per ton and the value of the by-products per ton of coke to $3.60, and the cost of coal per ton of coke was $5.04. These figures, of course, represent merely the gross value of the products and a single item of cost; they take no account of the other costs of manufacture, such as wages, salaries, purchased electric power, insurance, taxes, and fixed charges on a very large investment. No data on total cost and therefore on profits have been collected, but the diagram indicates clearly the trends of the market. Particularly important to the coke producers were the shifts in the values of the several by-products. (See fig. 32.) Increases in the values of tar and gas have more than offset a decline in the value of the benzols and ammonia, and the gross value of all the by-products reckoned per ton of coke is now much higher than before the war.

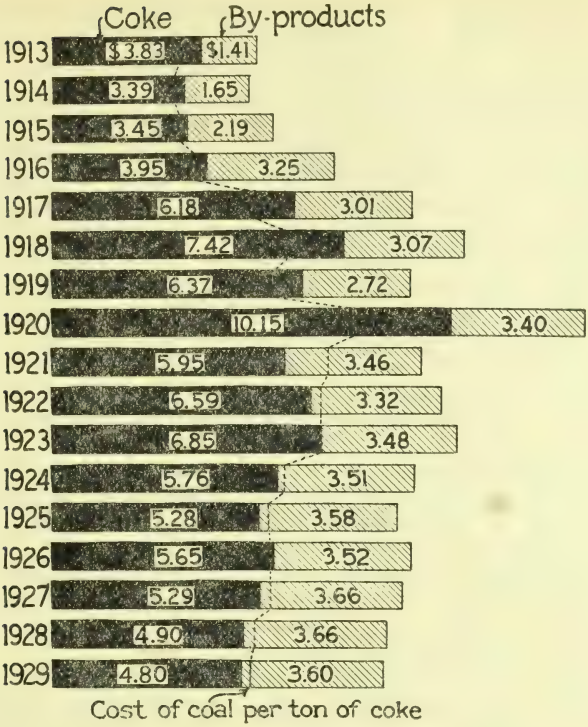

FIGURE 22.—Average value of by-product coke and gross value of by-products and cost of coal per ton of coke produced. It should be noted that these figures represent the gross values of the products and that there are many other expenses besides the cost of coking coal, including other materials, wages, salaries, purchased electric power, rents, insurance, taxes, and fixed charges on a large investment. No data on total cost or profits have been collected

TABLE 32.—*Cost of coal and value of all products per net ton of coke produced, 1913–1929*

[All figures reduced to value per net ton of coke produced]

Year	By-product coke					Beehive coke		
	Value of coke per ton[1]	Per ton of coke				Value of coke per ton[1]	Per ton of coke	
		Value of all by-products	Total value of products	Cost of coal	Excess, products over coal		Cost of coal	Excess, coke over coal
1913	$3.83	$1.41	$5.24	$3.27	$1.97	$2.39	$1.75	$0.64
1914	3.39	1.65	5.04	3.19	1.85	2.15	1.67	.48
1915	3.45	2.19	5.64	3.24	2.40	2.07	1.61	.46
1916	3.95	3.25	7.20	3.62	3.58	2.69	1.96	.73
1917	6.18	3.01	9.19	5.20	3.99	4.81	3.17	1.64
1918	7.42	3.07	10.49	6.00	4.49	6.21	3.65	2.56
1919	6.37	2.72	9.09	5.65	3.44	5.15	3.39	1.76
1920	10.15	3.40	13.55	7.73	5.82	7.94	4.90	3.04
1921	5.95	3.46	9.41	7.03	2.38	5.45	3.82	1.63
1922	6.59	3.32	9.91	6.81	3.10	5.84	4.05	1.79
1923	6.85	3.48	10.33	6.85	3.48	5.98	3.97	2.01
1924	5.76	3.51	9.27	5.95	3.32	4.70	3.44	1.26
1925	5.28	3.58	8.86	5.52	3.34	4.56	3.14	1.42
1926	5.65	3.52	9.17	5.55	3.62	4.57	3.08	1.49
1927	5.29	3.66	8.95	5.57	3.38	4.20	3.24	.96
1928	4.90	3.66	8.56	5.18	3.38	3.63	2.93	.70
1929	4.80	3.60	8.40	5.04	3.36	3.49	2.85	.64

[1] Includes operators' statements of the value of coke consumed by them in associated enterprises but not sold, except that in 1918 and 1920 the value of such coke was estimated for each State at the average value for that State of the part of the product reported sold.

PREPARATION AND SOURCE OF COAL CHARGED

WASHED AND UNWASHED COAL

Where the coals available for coke manufacture contain an undue proportion of ash or sulphur they are usually washed before being charged in the coke ovens. Table 33 shows the quantity of washed and unwashed coal consumed in the coke ovens of each State.

Producers of coking coal were among the pioneers in the development of the art of washing; and as early as 1890, when the statistical record begins, a considerable part of the coal made into coke was washed. The proportion of washed coal rose from 7.1 per cent in 1890 to a high point of 23.3 per cent in 1908, and since it has declined slightly. In 1923 it was 16.6 per cent.

These figures purport to include all washed coal, whether cleaned at the mine by the coal operator or at the ovens by the coke producer. Properly, they ought also to include coal cleaned by the several pneumatic processes that have recently been introduced and are technically considered forms of coal washing. The questionnaire used by the bureau, however, has not specifically asked that pneumatically cleaned coal be reported as washed, and although it is clear that some operators did so report it others probably did not. Since about 1925, therefore, when the tonnage of pneumatically cleaned coal began to be significant, the figures of washed coal charged may not be complete. In future reports of this series, however, special efforts will be made to include the pneumatically cleaned coal.

As it stands, Table 33 shows that 11,014,461 tons of washed coal was charged in by-product ovens and 1,495,222 tons in beehive ovens. The States in which washed coal was used most frequently were Alabama, Colorado, and parts of Pennsylvania.

TABLE 33.—*Washed and unwashed coal used in the manufacture of by-product and beehive coke, by States in which used, in 1929, in net tons*

State	Washed	Unwashed	Total
By-product ovens:			
Alabama	[1] 6,708,774	(1)	6,708,774
Colorado	830,575	173	830,748
Illinois	99,546	5,884,573	5,984,119
Indiana		8,748,928	8,748,928
Maryland		1,914,048	1,914,048
Massachusetts	(2)	[2] 1,126,370	1,126,370
Michigan	250,297	3,510,144	3,760,441
Minnesota		1,062,179	1,062,179
New Jersey		1,248,662	1,248,662
New York	176,051	6,007,867	6,183,918
Ohio		12,316,686	12,316,686
Pennsylvania	2,722,531	18,921,028	21,643,559
Tennessee	160,842		160,842
Utah		493,945	493,945
Washington	65,845		65,845
West Virginia		2,056,475	2,056,475
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin		2,453,419	2,453,419
	[1,2] 11,014,461	[1,2] 65,744,497	76,758,958
Beehive ovens:			
Colorado	225,331	12,595	237,926
Ohio and Pennsylvania	1,036,799	7,158,729	8,195,528
Tennessee	169,385		169,385
Utah		23,361	23,361
Virginia		527,280	527,280
Washington	34,894		34,894
West Virginia	28,813	810,329	839,142
	1,495,222	8,532,294	10,027,516

[1] A small amount of unwashed coal, which can not be shown separately, is included with the washed.

[2] A small amount of washed coal, which can not be shown separately, is included with the unwashed.

SOURCE OF BY-PRODUCT COAL IN 1929

Because of the wide interest in supplies of coal suitable for the manufacture of by-product coke the bureau asks each operator for a statement of the source of the coal charged during the year. In Table 34 the quantities reported are grouped by field of origin in as great detail as the nature of the replies permits. It is hoped that in future the analysis can be made more detailed and exact.

The Appalachian fields remain the great source of by-product coal, but it is interesting to note that 563,566 tons was drawn from southern Illinois, 953,168 tons from the Trinidad field of Colorado, 476,902 from Carbon County, Utah, and 65,845 from Pierce County, Wash.

Table 35 analyzes the distribution of by-product coking coal from State where produced to State where used.

TABLE 34.—*Coal used in the manufacture of by-product coke in 1929, by field of origin, in net tons*

Based upon detailed reports from each coke plant. The difference between these totals and those shown in Tables 3, 30, etc., is due to change in stock, loss of weight in handling, and to the fact that these sometimes represent purchases during the year rather than actual consumption]

State and district where coal was produced	Total used	States where coal was consumed—in order of importance
Alabama	6,830,062	Alabama.
Colorado:		
Trinidad	885,011	Colorado.
Pitkin	17,043	Utah.
Fremont, Garfield, and Gunnison	51,114	Colorado.
Georgia: Durham	25,975	Tennessee.
Illinois: Southern	563,566	Illinois.
Kentucky:		
Eastern Kentucky—		
Elkhorn	2,525,614	Michigan, Indiana, Kentucky, Ohio, New York, Minnesota, Illinois, Missouri, Massachusetts.
Harlan	6,017,533	Indiana, Illinois, Michigan, Ohio, Minnesota.
Pond Creek and Alma	787,489	Ohio.
Thacker	97,983	Illinois.
Pennsylvania:		
Connellsville	19,845,077	Pennsylvania, Ohio, New York, West Virginia, Illinois, Minnesota, Michigan, Indiana, New Jersey.
Pittsburgh	6,440,587	Pennsylvania, New York, Ohio, Massachusetts, Minnesota, Michigan, Illinois, West Virginia, Wisconsin, New Jersey.
Westmoreland	102,958	New York, Massachusetts.
Freeport	1,397,475	West Virginia, Indiana, Michigan.
Central Pennsylvania, high volatile	2,907,588	New York, Pennsylvania, Maryland.
Central Pennsylvania, low volatile	2,682,070	Pennsylvania, New York.
Somerset	379,634	Pennsylvania, Ohio.
Unspecified	375	Missouri.
Tennessee	120,676	Tennessee.
Utah: Carbon County	476,902	Utah.
Virginia: Wise, Lee, and Dickenson Counties.[1]	1,494,740	New York, New Jersey, Massachusetts, Illinois, Missouri, Tennessee.
Washington: Pierce County	65,845	Washington.
West Virginia:		
Northern	4,304,793	Pennsylvania, Maryland, Ohio, West Virginia, New Jersey, New York.
Kanawha and Logan	4,690,119	Indiana, Illinois, Michigan, Wisconsin, Ohio, Rhode Island, Massachusetts, New York, Kentucky, Minnesota, Missouri.
Pocahontas [1]	11,829,184	Indiana, Ohio, Illinois, New York, Michigan, West Virginia, Pennsylvania, Minnesota, Wisconsin, Kentucky, Alabama, Connecticut, Missouri, Massachusetts, Tennessee.
New River and Winding Gulf	2,512,766	Illinois, New Jersey, New York, Connecticut, Pennsylvania, Massachusetts, Indiana, Minnesota, Rhode Island, Missouri.
Thacker	12,351	Indiana.
	77,064,530	

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[1] Coal from the extension of the Pocahontas field in Tazewell County, Va., is included under West Virginia (Pocahontas).

TABLE 35.—*Coal used in the manufacture of by-product coke in 1929, by State where produced and State where consumed, in net tons*

State where coal was used	Coal produced in—					
	Alabama	Colorado	Georgia	Illinois	Kentucky	Pennsylvania
Alabama	6,830,062					
Colorado		936,125				
Illinois				563,566	1,847,183	(1)
Indiana					2,515,896	658,921
Maryland						727,758
Massachusetts					60,624	324,993
Michigan					(1)	(1)
Minnesota					335,382	308,990
New Jersey						1,689
New York					(1)	3,739,306
Ohio					2,069,786	6,614,558
Pennsylvania						19,148,541
Tennessee			25,975			
Utah		17,043				
Washington						
West Virginia						1,443,239
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin					(1)	2,600
Undistributed					2,600,748	773,217
	6,830,062	953,168	25,975	563,566	9,429,619	33,743,812

State where coal was used	Coal produced in—						
	Tennessee	Utah	Virginia [2]	Washington	West Virginia [2]	Miscellaneous	Total [3]
Alabama					127,891		6,957,953
Colorado							936,125
Illinois			(1)		3,046,180		5,973,322
Indiana					5,574,111		8,748,928
Maryland					1,186,290		1,914,048
Massachusetts			250,236		497,462		1,133,315
Michigan					1,632,672		3,760,153
Minnesota					417,806		1,062,178
New Jersey			590,436		619,715	11,577	1,223,417
New York			(1)		1,516,419		6,149,749
Ohio					3,629,848		12,314,192
Pennsylvania					2,494,515		21,643,056
Tennessee	120,676		3,142		15,187		164,980
Utah		476,902					493,945
Washington				65,845			65,845
West Virginia					613,236		2,056,475
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin			4,040		1,976,881	375	2,466,849
Undistributed			646,886				
	120,676	476,902	1,494,740	65,845	23,348,213	11,952	77,064,530

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[1] Included under "Undistributed."

[2] Coal from the extension of the Pocahontas field in Tazewell County, Va., is included under West Virginia.

[3] Difference between these totals and those shown in Tables 3, 30, etc., is due to change in stock, loss of weight in handling, and to the fact that these sometimes represent purchases made during the year rather than actual consumption.

YIELD OF COKE PER TON OF COAL

TABLE 36.—*Percentage yield of coke from coal in by-product and beehive ovens, by States, 1926–1929*

State	1926		1927		1928		1929	
	By-product	Beehive	By-product	Beehive	By-product	Beehive	By-product	Beehive
Alabama	70.3	(1)	70.4	----------	69.6	----------	70.9	----------
Colorado	69.0	64.2	68.5	64.8	68.0	65.4	68.0	65.7
Georgia	----------	59.7	----------	(1)	----------	(1)	----------	----------
Illinois	70.8	----------	69.0	----------	68.8	----------	70.3	----------
Indiana	74.9	----------	74.5	----------	74.3	----------	73.8	----------
Kentucky	(1)	59.0	(1)	(1)	(1)	(1)	(1)	----------
Maryland	73.1	----------	73.0	----------	72.5	----------	72.8	----------
Massachusetts	65.6	----------	68.1	----------	66.4	----------	69.0	----------
Michigan	72.4	----------	71.3	----------	70.6	----------	71.3	----------
Minnesota	68.6	----------	68.8	----------	69.2	----------	70.2	----------
New Jersey	72.5	----------	72.8	----------	72.1	----------	71.9	----------
New Mexico	----------	(1)	----------	----------	----------	----------	----------	----------
New York	71.6	----------	70.4	----------	69.1	----------	69.5	----------
Ohio	68.9	67.5	68.9	(1)	67.9	(1)	69.2	(2)
Pennsylvania	66.3	65.6	66.3	65.5	66.3	65.4	66.9	[2] 65.5
Tennessee	71.9	56.8	75.3	56.4	74.7	59.8	70.4	56.6
Utah	56.6	59.6	61.9	59.7	55.0	57.7	54.2	60.2
Virginia	----------	61.8	----------	60.0	----------	58.9	----------	59.7
Washington	63.0	62.9	62.5	64.0	63.2	63.9	62.1	74.1
West Virginia	69.2	61.0	67.6	58.7	69.5	58.8	69.6	59.3
Average	69.7	65.0	69.4	64.3	68.9	64.0	69.6	64.5

[1] Not at liberty to publish data.

[2] Ohio included with Pennsylvania.

COKE BREEZE

The manufacture of coke produces appreciable percentages of coke breeze or screenings too fine for metallurgical or household use. Logically this material, which probably averages somewhat more than 12,000 B. t. u. per pound on a dry basis, should be considered part of the coke production because of its value as a fuel. Inclusion of this material, however, would not conform to the general trade usage. Moreover, present and past production could not then be accurately compared, for statistical records of breeze produced before 1916 are fragmentary. Hence, breeze is treated in this report as a by-product, and the term "coke" refers only to the larger material from which the screenings have been removed. The size of the material classed as breeze varies with the different plants, but it may be described roughly as corresponding to the steam sizes of anthracite. Table 37 indicates that in the beehive branch of the industry the problem of finding a profitable outlet for breeze remains unsolved. The quantity reported as produced in 1929 was only 225,399 tons, a small part of the total quantity of fine material resulting from the carbonization of the coal charged during the year. Limited amounts of the breeze produced in beehive ovens are used by the producer for steam raising and other purposes, and even smaller quantities are sold. Uses ordinarily can be found for the breeze produced at by-product coke plants, and the amount wasted is negligible.

TABLE 37.—*Coke breeze recovered at coke plants, by States, in 1929*

State	Yield (per cent of coal)	Produced		Used for steam raising		Used for other purposes by producer		Sold		On hand Dec. 31 (net tons)	Wasted (net tons)
		Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value		
By-product ovens:											
Alabama	3.9	261,546	$339,010	163,612	$210,621	14,063	$22,220	63,376	$75,146	61,792	22,329
Colorado	5.0	41,262	(1)	45,618	(1)					135	
Illinois	6.5	387,500	1,131,773	215,885	545,298	73,030	228,388	82,539	255,655	146,261	
Indiana	5.5	478,239	1,285,675	356,961	923,043	51,727	99,392	73,501	277,105	46,221	
Maryland	6.5	122,672	(1)	72,387	(1)	21,140	(1)	23,688	(1)	19,619	
Massachusetts	7.0	78,674	250,818	8,195	14,981	6,058	16,200	49,103	159,622	14,116	
Michigan	5.6	208,960	570,842	172,687	478,407	5,401	13,055	60,467	128,893	13,820	
Minnesota	6.4	67,881	216,062	23,537	67,605	(1)	(1)	29,784	100,320	14,328	
New Jersey	3.3	41,045	(1)	40,700	(1)			168	(1)	5,005	
New York	5.6	344,279	841,062	227,541	536,246	56,968	185,539	48,469	90,643	34,227	
Ohio	7.3	898,623	2,038,213	541,126	980,146	64,861	144,956	237,705	768,949	88,508	
Pennsylvania	7.4	1,596,203	2,781,319	1,274,240	2,099,896	91,584	132,791	198,259	499,717	33,015	
Tennessee	4.3	6,931	13,862	5,684	11,425			75	75	7,285	
Utah	8.6	42,697	(1)					42,697	(1)	25,277	
Washington	6.3	4,148	4,148	3,873	3,873	267	267	8	8		
West Virginia	4.9	101,142	121,222	73,483	87,793	(1)	(1)	10,254	15,431	22,873	
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	7.0	170,918	474,203	136,216	292,665	33,745	200,838	2,600	9,579	14,162	
Undistributed			583,219		321,003	21,366	93,963		217,635		
	6.3	4,852,720	10,651,428	3,360,865	6,573,002	440,210	1,137,609	922,693	2,598,778	546,644	22,329
Beehive ovens:											
Colorado and Utah	[2] 2.6	6,442	12,233	1,527	3,494	102	359	4,775	8,323		
Ohio and Virginia	[2] .9	3,169	7,118			568	965	2,543	6,070	20	88
Pennsylvania	[2] 4.5	214,193	170,529	71,834	44,897	1,308	1,076	28,827	34,704	137,224	21,553
West Virginia	[2] 1.3	1,595	1,991					1,245	1,693		50
	[2] 4.1	225,399	191,871	73,361	48,391	1,978	2,400	37,390	50,790	137,244	[3] 21,691

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[1] Included under "Undistributed."

[2] Yield computed by dividing the production of the breeze at the few plants reporting by the quantity of coal charged at these plants.

[3] As reported; quantity produced but not used was undoubtedly greater. See Mineral Resources, 1922, Pt. II, pp. 726–727.

CONSUMPTION OF COKE

Calculated total consumption.—Records of the consumption of coke are important because of the light they throw on the trend of demand and hence on the prospects for future expansion of the industry. Projects for construction of new ovens should be considered carefully, not only with regard to immediate requirements but to the long-time growth of consumption.

The aggregate consumption of the country may be calculated easily by adding the production and imports, subtracting the exports, and allowing for changes in producers' stocks. This is done in Table 38 for each year from 1913 to the present. For 1929 the indicated United States consumption, calculated in this way, was 58,352,535 tons, the largest in the history of the industry. In comparison with 1918 the year showed an increase of 3,532,000 tons.

Consumption by iron furnaces.—For the principal branch of consumption, the smelting of iron in blast furnaces, a yearly record of the quantity actually used is kept by the iron companies themselves, and this record is shown in the sixth column of Table 38. In 1929 the blast-furnace consumption was 43,720,000 tons. Although greater than in 1928 it was less than in 1923, 1918, 1917, or 1916, in spite of the fact that the tonnage of pig iron produced in 1929 was larger than ever before. This remarkable performance has been made possible by the steady decline in the consumption of fuel per ton of pig. As shown by Table 39 and Figure 23 the quantity of coking coal required to make a gross ton of iron declined from an average of 3,637.2 pounds in 1913 to 2,983.5 pounds in 1929. The decline is due partly to the increasing burden of scrap but also represents improvements in fuel efficiency in the blast furnace and improvements in the yield and quality of the coke. The net result of these savings has more than offset the increase in tonnage of iron produced, so that the annual consumption of coke for this purpose in recent years has shown no consistent gain.

Consumption for all other purposes.—Actual records of the tonnage used by other consumers are fragmentary and available only at long intervals. The total used for all other purposes may be calculated by subtracting from the indicated total consumption the quantity known to have been charged in iron furnaces. This is done in the eighth column of Table 38. The remainder includes the consumption in foundry work, in smelting nonferrous metals, making water gas, and other industrial uses, also that in domestic heating. The calculated total for these uses in 1929 was 14,632,535 tons, or 25.1 per cent of the national consumption, as against 8,221,060 tons, or 18.1 per cent, in 1913. Thus, the consumption for purposes other than iron manufacture has shown a large increase in contrast to the stationary or even declining furnace demand.

To assist students of the market the other sources of information on actual consumption of coke should be briefly mentioned. The quantity consumed in the manufacture of city gas is reported by the biennial Census of Manufactures.[5] The quantity consumed in other manufacturing industries appears in the decennial Census of 1919 [6] and will appear again in the final reports of the Census of 1929.

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[5] United States Bureau of the Census, Manufactures; The Gas and Coke Industries: 1927, p. 9.

[6] United States Bureau of the Census, Fourteenth Census, Manufactures: Vol. 8, 1919, pp. 131–141.

TABLE 38.—*Quantity of coke consumed in the manufacture of pig iron and for other purposes, 1913–1929, in net tons*

Year	Total production of coke	Imports	Exports	Net changes in producers' stocks	Indicated United States consumption [1]	Consumed by iron furnaces [2]		Remainder consumed in other ways	
						Quantity	Per cent	Quantity	Per cent
1913	46, 299, 530	101, 212	987, 395	(3)	45, 413, 347	37, 192, 287	81. 9	8, 221, 060	18. 1
1914	34, 555, 914	133, 226	663, 585	(3)	34, 025, 555	27, 070, 856	79. 6	6, 954, 699	20. 4
1915	41, 581, 150	53, 222	895, 509	(3)	40, 738, 863	33, 224, 328	81. 6	7, 514, 535	18. 4
1916	54, 533, 585	54, 955	1, 174, 645	(3)	53, 413, 895	44, 431, 905	83. 2	8, 981, 990	16. 8
1917	55, 606, 828	24, 872	1, 409, 320	(3)	54, 222, 380	44, 493, 316	82. 1	9, 729, 064	17. 9
1918	56, 478, 372	30, 168	1, 687, 824	(3)	54, 820, 716	45, 703, 594	83. 4	9, 117, 122	16. 6
1919	44, 180, 557	16, 486	716, 956	(3)	43, 480, 087	35, 250, 943	81. 1	8, 229, 144	18. 9
1920	51, 345, 043	41, 143	919, 802	(3)	50, 466, 384	41, 976, 171	83. 2	8, 490, 213	16. 8
1921	25, 287, 622	30, 990	306, 755	(3)	25, 011, 857	18, 162, 147	72. 6	6, 849, 710	27. 4
1922	37, 124, 012	94, 228	511, 541	−805, 000	37, 511, 699	29, 213, 893	77. 9	8, 297, 806	22. 1
1923	56, 977, 534	85, 002	1, 237, 342	+651, 737	55, 173, 457	44, 761, 526	81. 1	10, 411, 931	18. 9
1924	44, 269, 605	82, 833	659, 350	−258, 020	43, 951, 108	34, 303, 060	78. 0	9, 648, 048	22. 0
1925	51, 266, 943	201, 579	953, 812	−854, 561	51, 369, 271	39, 241, 812	76. 4	12, 127, 459	23. 6
1926	56, 865, 537	284, 548	987, 260	+600, 021	55, 562, 804	[4]40, 600, 000	73. 1	14, 962, 804	26. 9
1927	51, 092, 143	168, 859	806, 664	+580, 293	49, 874, 045	[4]38, 200, 000	76. 6	11, 674, 045	23. 4
1928	52, 805, 828	147, 701	1, 097, 666	−38, 508	51, 894, 371	[4]39, 695, 000	76. 5	12, 199, 371	23. 5
1929	59, 883, 845	119, 724	1, 238, 035	+412, 999	58, 352, 535	[4]43, 720, 000	74. 9	14, 632, 535	25. 1

[1] Production plus imports minus exports, plus or minus the decrease or increase, respectively, of the net changes in stocks.

[2] From Annual Statistical Report of American Iron and Steel Institute.

[3] Data not available.

[4] Includes an estimate for coke consumed in the manufacture of ferro-alloys which was not reported by the institute.

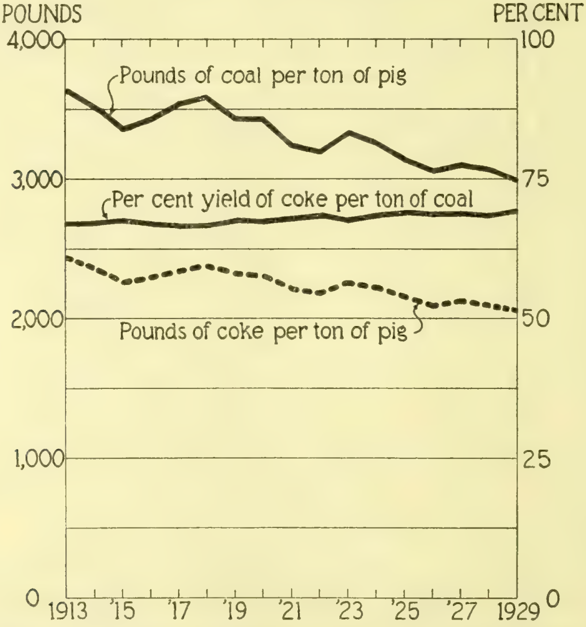

FIGURE 23.—Declining consumption of blast-furnace coke per gross ton of pig iron, 1913–1929. The quantity of coke consumed per ton of pig iron has been declining. At the same time, the yield of coke per ton of coal carbonized has increased slightly so that the consumption of coking coal per ton of pig iron produced has declined from 3,637 pounds in 1913 to 2,984 in 1929

TABLE 39.—*Pounds of coke and of coking coal consumed per gross ton of pig iron made in the United States, 1913–1929*

Year	Pounds of coke per gross ton of pig iron and ferro-alloys[1]	Per cent yield of coke from coal	Calculated pounds coking coal per gross ton of pig iron and ferro-alloys	Year	Pounds of coke per gross ton of pig iron and ferro-alloys[1]	Per cent yield of coke from coal	Calculated pounds coking coal per gross ton of pig iron and ferro-alloys
1913	2,433.3	66.9	3,637.2	1922	2,176.3	68.3	3,186.4
1914	2,354.4	66.9	3,519.3	1923	2,243.3	67.5	3,323.4
1915	2,252.0	67.2	3,351.2	1924	2,212.0	68.1	3,248.2
1916	2,285.3	66.8	3,421.1	1925	2,150.4	68.8	3,125.6
1917	2,339.7	66.4	3,523.6	1926	2,091.2	68.6	3,048.4
1918	2,375.2	66.4	3,577.1	1927	2,122.3	68.6	3,093.7
1919	2,310.2	67.4	3,427.6	1928	2,088.5	68.4	3,053.4
1920	2,305.6	67.4	3,420.8	1929	2,058.6	69.0	2,983.5
1921	2,200.6	68.0	3,236.2				

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[1] From Annual Statistical Report of American Iron and Steel Institute, 1929, p. 17. Beginning in 1926 the institute began to show the consumption per ton of pig iron only, excluding the furnaces making ferro-alloys. The results were 2,060.9 pounds in 1926; 2,094.1 in 1927; 2,059.3 in 1928; and 2,030.9 in 1929.

FURNACE, FOUNDRY, AND OTHER COKE

SOURCE OF INFORMATION

Another approach to the problem of measuring the consumption of coke is to ask the producer to state the purpose for which his output is consumed. Not all producers can furnish this information, especially for such of their product as is sold through middlemen; but the bureau does ask for the use to which that part of the output consumed by the producer is put and does ask, also, for separation of the sales into the broad classifications "furnace," "foundry," "other industrial," and "domestic."

In this connection it must be remembered that the terms "furnace coke" and "foundry coke," as used in the trade, refer to the size and grade of the coke as well as to the use for which it may be intended. As explained more fully in Coke and By-Products in 1922, pages 729 and 730, by-product furnace coke is ordinarily run-of-oven coke from which the breeze and all small coke of less than, say, three-quarters inch in diameter have been removed. By-product foundry coke is ordinarily a blocky coke of maximum size much greater than that of furnace coke, from which all sizes under 2½ to 3 inches are screened out. Coke of smaller size than furnace or foundry (exclusive, however, of the breeze) is often called domestic coke. It may result from the screening of foundry or furnace coke; or, where the principal demand is for domestic coke, it may be obtained by crushing the larger fragments. Other special sizes and grades may be prepared for special purposes. Thus not all furnace coke finds its way to iron blast furnaces nor all foundry coke to iron foundries proper, for either grade may be purchased by other classes of consumers.

Considering the form in which producers keep their records the bureau has adopted the following form of inquiry:

Disposal of large coke

	Net tons	Value at ovens
Used by producer, not sold:		
In blast furnaces	------	$----------
For other purposes (specify)	------	----------
Sold for furnace use (metallurgical only):		
To financially affiliated corporations	------	----------
To other merchant consumers	------	----------
Sold for foundry use	------	----------
Sold for domestic use	------	----------
Sold for industrial and other use	------	----------

Tables 40 to 43 analyze producers' replies to these questions, which have been used with some modifications since 1923.

DISPOSAL OF BY-PRODUCT COKE IN 1929

In 1929 the producers of by-product coke reported sales of 16,005,831 tons, of which 3,470,115 tons were furnace coke sold to affiliated corporations, 1,351,483 tons were furnace coke sold to nonaffiliated purchasers (merchant sales), 2,114,690 tons were foundry coke, 1,693,223 tons were coke for other industrial uses (including the manufacture of water gas), and 7,376,320 tons were coke sold for domestic use. (See Table 40.) The quantity not sold but used by the producers themselves was 37,041,241 tons. Of this 35,755,470 tons were used in blast furnaces and 1,285,771 tons for other purposes. Chief among these other uses were the making of producer gas and water gas—the latter at plants supplying coke-oven gas for city distribution—and the melting of iron in the cupola.

TABLE 40.—*By-product coke produced and sold or used by the producer, by States, in 1929*

[Exclusive of screenings and breeze]

State	Produced		Used by producer in blast furnace, etc.		Sold									
					Furnace [1]		Foundry		Other industrial use (including water gas)		Domestic use		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	4,753,967	$12,659,148	3,661,940	$8,852,484	22,675	$61,833	428,851	$1,856,623	72,609	$230,280	418,602	$1,324,572	942,737	$3,473,308
Colorado	565,031	(2)	515,327	(2)	----------	----------	----------	----------	14,677	(2)	1,663	(2)	16,340	(2)
Illinois	4,204,116	26,036,197	2,564,257	15,825,273	(2)	(2)	(2)	(2)	247,016	1,373,351	981,418	5,787,987	1,611,445	9,858,802
Indiana	6,455,378	41,208,876	5,748,025	37,003,917	----------	----------	270,033	1,971,601	25,053	150,582	416,272	2,106,345	711,358	4,228,528
Maryland	1,393,052	(2)	1,325,463	(2)	----------	----------	----------	----------	68,873	(2)	1,511	(2)	70,384	(2)
Massachusetts	776,679	5,919,159	19,152	133,222	(2)	(2)	(2)	(2)	(2)	(2)	318,462	2,696,829	757,124	5,778,226
Michigan	2,679,971	14,867,651	577,264	2,278,946	(2)	(2)	(2)	(2)	164,080	962,087	1,528,055	9,298,936	2,046,831	12,304,196
Minnesota	746,004	6,478,228	352,213	3,033,065	(2)	(2)	----------	----------	(2)	(2)	(2)	(2)	395,392	3,486,206
New Jersey	897,530	(2)	92,940	(2)	67,491	(2)	73,484	(2)	245,038	(2)	468,504	(2)	854,517	(2)
New York	4,299,470	25,305,915	1,752,326	9,021,983	1,108,614	6,444,048	(2)	(2)	(2)	(2)	1,049,304	7,239,483	2,556,935	16,356,091
Ohio	8,521,132	35,202,383	6,567,594	26,172,857	834,394	3,979,084	221,672	1,536,063	161,414	673,911	630,648	2,453,726	1,848,128	8,642,784
Pennsylvania	14,489,283	55,088,803	12,365,479	44,969,728	1,708,041	7,245,181	52,707	391,720	99,728	720,165	192,578	1,327,577	2,053,054	9,684,643
Tennessee	113,285	672,913	26,719	126,154	22,545	98,071	16,929	82,106	----------	----------	91,096	628,562	130,570	808,739
Utah	267,939	(2)	164,305	(2)	99,582	(2)	4,052	(2)	----------	----------	----------	----------	103,634	(2)
Washington	40,879	286,153	37,517	262,619	----------	----------	----------	----------	----------	----------	5,178	36,246	5,178	36,246
West Virginia	1,431,314	3,610,883	1,178,132	2,632,378	(2)	(2)	(2)	(2)	9,689	23,138	(2)	(2)	223,789	890,635
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,776,796	12,668,372	92,588	607,303	(2)	(2)	435,601	3,389,136	(2)	(2)	864,427	6,672,475	1,678,415	12,006,615
Undistributed	----------	16,425,487	----------	9,224,113	958,256	6,381,975	611,361	5,503,430	585,046	5,637,882	408,602	6,725,110	----------	7,455,096
	53,411,826	256,430,168	[3] 37,041,241	[3] 160,144,042	4,821,598	24,210,192	2,114,690	14,730,679	1,693,223	9,771,396	7,376,320	46,297,848	16,005,831	95,010,115

[1] Includes 3,470,115 tons, valued at $16,941,539, sold to affiliated corporations, and 1,351,483 tons, valued at $7,268,653, reported as merchant sales.

[2] Included under "Undistributed."

[3] Includes 1,285,771 tons, valued at $8,446,467, used for other purposes than in blast furnaces.

DISPOSAL OF BEEHIVE COKE IN 1929

Corresponding data for beehive coke as reported by the producers are given in Table 41. In 1929 the total sales amounted to 5,539,785 tons, including 1,174,374 tons of furnace coke sold to affiliated corporations; 2,815,114 tons of "merchant sales" for furnace use; 773,818 tons for foundry use; 641,776 tons for other industrial uses, including manufacture of water gas; and 134,703 tons for domestic use. The quantity of beehive coke used by the producers themselves was 933,395 tons, of which all but 31,802 tons was consumed in iron blast urnaces.

TABLE 41.—*Beehive coke produced and sold or used by the producer, by States, in 1929*

[Exclusive of screenings and breeze]

State	Produced		Used by producer in blast furnace, etc.[1]		Sold									
					Furnace[2]		Foundry		Other industrial use (including water gas)		Domestic use		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Colorado	156,426	(3)	20,159	(3)	(3)	(3)	(3)	(3)	23,640	(3)	16,861	(3)	137,536	(3)
Georgia							346	$1,576					346	$1,576
Pennsylvania and Ohio	5,367,685	$17,824,426	819,793	$3,067,552	3,558,084	$11,055,857	514,550	2,270,753	360,088	$1,048,709	112,984	$369,401	4,545,706	14,744,720
Tennessee	95,881	413,461	(3)	(3)	26,923	93,284	(3)	(3)					30,034	109,159
Utah	14,055	(3)					14,055	(3)					14,055	(3)
Virginia	314,859	1,283,740	(3)	(3)	(3)	(3)	65,639	298,538	198,774	813,208	7	(3)	316,861	1,293,598
Washington	25,844	207,674	25,429	203,517			415	4,157					415	4,157
West Virginia	497,269	1,675,544	(3)	(3)	255,155	785,992	175,552	677,334	59,274	(3)	4,851	(3)	494,832	1,632,979
Undistributed		1,159,579	68,014	429,893	149,326	878,092	3,261	128,487		283,259		130,929		1,053,387
	6,472,019	22,564,424	933,395	3,700,962	3,989,488	12,813,225	773,818	3,380,845	641,776	2,145,176	134,703	500,330	5,539,785	18,839,576

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[1] Includes 31,802 tons, valued at $233,007, used for other purposes than in blast furnaces.

[2] Includes 1,174,374 tons, valued at $4,576,983, sold to affiliated corporations, and 2,815,114 tons, valued at $8,236,242, reported as merchant sales.

[3] Included under "Undistributed."

RELATIVE GROWTH OF FURNACE, FOUNDRY, AND OTHER COKE

The record of the disposal of the product in previous years, as reported by the operators, is brought together in Tables 42 and 43, which indicate the relative growth of the sales for furnace, foundry, and domestic use. Table 42 shows the sales so classified and the quantity used by the producer for each year from 1918 to 1929. From 1918 to 1922 the operators were merely asked to state the total quantity of furnace, of foundry, and of domestic coke sold. From 1923 to 1929 the figures of sales are based upon replies to detailed questions substantially as listed on page 610. The change in form of inquiry affects the comparability of the figures before 1923, but from that year to the present they are entirely comparable. The movement of prices of the several grades of coke is indicated by the figures of average value per ton at the bottom of Table 42. (See also fig. 28.)

TABLE 42.—*Coke used by producer and sold for furnace, foundry, other industrial, and domestic use, 1918–1929*

[Exclusive of screenings and breeze]

Year	Used by producer in blast furnace or other affiliated works	Sold					
		Furnace		Foundry	Other industrial use (including water gas)	Domestic use	Total sales
		To affiliated corporations	Merchant sales				
Quantity (net tons):							
By-product—							
1918	17,753,348	4,147,695		1,631,052	2,537,059		8,315,806
1919	17,767,066	4,677,497		1,480,516	2,885,270		9,043,283
1920	22,848,461	4,054,964		1,715,982	2,361,737		8,132,683
1921	13,470,396	2,593,318		736,391	1,679,911		5,009,620
1922	21,106,823	2,934,924		1,601,733	3,865,751		8,402,408
1923	27,055,397	2,313,412	1,460,538	1,897,955	1,638,226	2,637,518	9,947,649
1924	24,023,933	2,335,056	1,590,983	1,553,849	1,556,175	2,812,771	9,848,834
1925	28,223,838	2,641,729	1,736,112	1,833,372	2,072,635	4,085,068	12,368,916
1926	31,334,305	2,127,176	1,566,980	2,168,017	1,662,837	5,056,568	12,581,578
1927	30,687,198	2,959,247	967,277	1,938,653	2,022,838	4,702,529	12,590,544
1928	33,938,915	3,136,547	1,652,531	1,955,294	1,318,629	6,254,382	14,317,383
1929	37,041,241	3,470,115	1,351,483	2,114,690	1,693,223	7,376,320	16,005,831
Beehive—							
1918	4,885,318	23,216,627		2,230,156	210,511		25,657,294
1919	3,023,828	14,574,264		1,349,483	143,930		16,067,677
1920	3,204,884	15,188,814		1,807,256	192,142		17,188,212
1921	495,481	3,957,709		1,011,343	56,874		5,025,926
1922	1,071,886	6,105,003		1,164,716	179,670		7,449,389
1923	2,583,507	7,923,783	6,437,771	1,702,764	645,662	95,896	16,805,876
1924	1,574,037	3,582,004	3,357,433	1,363,952	260,046	139,886	8,703,321
1925	2,032,944	3,479,728	3,895,983	1,153,665	572,949	392,698	9,495,023
1926	1,575,039	4,260,028	4,156,032	1,163,660	963,797	386,045	10,929,562
1927	905,359	2,017,616	2,780,433	809,590	569,749	111,103	6,288,491
1928	370,629	808,123	2,045,591	755,312	445,745	78,338	4,133,109
1929	933,395	1,174,374	2,815,114	773,818	641,776	134,703	5,539,785
Total—							
1918	22,638,666	27,364,322		3,861,208	2,747,570		33,973,100
1919	20,790,894	19,251,761		2,829,999	3,029,200		25,110,960
1920	26,053,345	19,243,778		3,523,238	2,553,879		25,320,895
1921	13,965,877	6,551,027		1,747,734	1,736,785		10,035,546
1922	22,178,709	9,039,927		2,766,449	4,045,421		15,851,797
1923	29,638,904	10,237,195	7,898,309	3,600,719	2,283,888	2,733,414	26,753,525
1924	25,597,970	5,917,060	4,948,416	2,917,801	1,816,221	2,952,657	18,552,155
1925	30,256,782	6,121,457	5,632,095	2,987,037	2,645,584	4,477,766	21,863,939
1926	32,909,344	6,387,204	5,723,012	3,331,677	2,626,634	5,442,613	23,511,140
1927	31,592,557	4,976,863	3,747,710	2,748,243	2,592,587	4,813,632	18,879,035
1928	34,309,544	3,944,670	3,698,122	2,710,606	1,764,374	6,332,720	18,450,492
1929	37,974,636	4,644,489	4,166,597	2,888,508	2,334,999	7,511,023	21,545,616
Total value:							
By-product—							
1918	(1)	$30,792,247		$15,849,017	$18,907,079		$65,548,343
1919	(1)	31,028,251		12,865,927	15,607,752		59,501,930
1920	(1)	42,841,222		23,678,225	21,080,429		87,599,876
1921	(1)	17,202,994		7,662,781	13,809,165		38,674,940
1922	(1)	20,636,494		15,921,431	34,407,054		70,964,979
1923	$168,379,600	$16,307,054	$9,847,055	19,995,342	$14,845,652	$23,872,007	84,867,110
1924	125,838,387	13,495,287	9,149,521	13,425,334	11,854,698	20,063,417	67,988,257

[1] No data.

TABLE 42.—*Coke used by producer and sold for furnace, foundry, other industrial, and domestic use, 1918–1929*—Continued

[Exclusive of screenings and breeze]

Year	Used by producer in blast furnace or other affiliated works	Sold					
		Furnace		Foundry	Other industrial use (including water gas)	Domestic use	Total sales
		To affiliated corporations	Merchant sales				
Total value—Con.							
By-product—Continued.							
1925	$134,245,288	$13,794,422	$9,954,964	$14,630,450	$14,849,829	$28,521,425	$81,751,090
1926	160,606,129	10,955,119	9,800,299	16,836,376	12,285,212	37,567,659	87,444,665
1927	145,123,216	15,903,197	5,393,276	15,112,967	13,812,393	32,447,939	82,669,772
1928	150,956,628	15,007,542	8,894,711	13,645,407	8,678,854	38,959,815	85,186,329
1929	160,144,042	16,941,539	7,268,653	14,730,679	9,771,396	46,297,848	95,010,115
Beehive—							
1918	(1)	137,782,308		16,802,144	1,319,053		155,903,505
1919	(1)	72,007,820		8,364,256	775,467		81,147,543
1920	(1)	108,943,650		17,209,737	1,545,147		127,698,534
1921	(1)	20,979,386		5,932,599	272,412		27,184,397
1922	(1)	33,724,440		8,334,400	1,086,014		43,144,854
1923	14,045,646	45,756,993	39,326,693	12,259,196	4,112,236	461,971	101,917,089
1924	7,872,356	17,706,496	13,507,138	7,543,143	1,052,249	509,333	40,318,359
1925	9,502,959	16,497,801	15,722,122	5,971,595	2,494,947	2,240,546	42,927,011
1926	7,148,961	20,306,453	16,384,006	5,967,936	4,638,542	2,677,741	49,974,678
1927	4,035,732	9,153,274	10,243,163	4,085,876	2,154,443	446,236	26,082,992
1928	1,658,117	3,099,214	6,699,956	3,306,458	1,715,678	295,904	15,117,210
1929	3,700,962	4,576,983	8,236,242	3,380,845	2,145,176	500,330	18,839,576
Total—							
1918	(1)	168,574,555		32,651,161	20,226,132		221,451,848
1919	(1)	103,036,071		21,230,183	16,383,219		140,649,473
1920	(1)	151,784,872		40,887,962	22,625,576		215,298,410
1921	(1)	38,182,380		13,595,380	14,081,577		65,859,337
1922	(1)	54,360,934		24,255,831	35,493,068		114,109,833
1923	182,425,246	62,064,047	49,173,748	32,254,538	18,957,888	24,333,978	186,784,199
1924	133,710,743	31,201,783	22,656,659	20,968,477	12,906,947	20,572,750	108,306,616
1925	143,748,247	30,292,223	25,677,086	20,602,045	17,344,776	30,761,971	124,678,101
1926	167,755,090	31,261,572	26,184,305	22,804,312	16,923,754	40,245,400	137,419,343
1927	149,158,948	25,056,471	15,636,439	19,198,843	15,966,836	32,894,175	108,752,764
1928	152,614,745	18,106,756	15,594,667	16,951,865	10,394,532	39,255,719	100,303,539
1929	163,845,004	21,518,522	15,504,895	18,111,524	11,916,572	46,798,178	113,849,691
Value per ton:							
By-product—							
1918	(1)	7.42		9.72	7.45		7.88
1919	(1)	6.63		8.69	5.41		6.58
1920	(1)	10.57		13.80	8.93		10.77
1921	(1)	6.63		10.41	8.22		7.72
1922	(1)	7.03		9.94	8.90		8.45
1923	6.22	7.05	6.74	10.54	9.06	9.05	8.53
1924	5.24	5.78	5.75	8.64	7.62	7.13	6.90
1925	4.76	5.22	5.73	7.98	7.16	6.98	6.61
1926	5.13	5.15	6.25	7.77	7.39	7.43	6.95
1927	4.73	5.37	5.58	7.80	6.83	6.90	6.57
1928	4.45	4.78	5.38	6.98	6.58	6.23	5.95
1929	4.32	4.88	5.38	6.97	5.77	6.28	5.94
Beehive—							
1918	(1)	5.93		7.53	6.27		6.08
1919	(1)	4.94		6.20	5.39		5.05
1920	(1)	7.17		9.52	8.04		7.43
1921	(1)	5.30		5.87	4.79		5.41
1922	(1)	5.52		7.15	6.04		5.79
1923	5.44	5.77	6.11	7.20	6.37	4.82	6.06
1924	5.00	4.94	4.02	5.53	4.05	3.64	4.63
1925	4.67	4.74	4.04	5.18	4.35	5.71	4.52
1926	4.54	4.77	3.94	5.13	4.81	6.94	4.57
1927	4.46	4.54	3.68	5.05	3.78	4.02	4.15
1928	4.47	3.79	3.28	4.38	3.85	3.78	3.66
1929	3.97	3.90	2.93	4.37	3.34	3.71	3.40
Total—							
1918	(1)	6.16		8.46	7.36		6.52
1919	(1)	5.35		7.50	5.41		5.60
1920	(1)	7.89		11.61	8.86		8.50
1921	(1)	5.83		7.78	8.11		6.56
1922	(1)	6.01		8.77	8.77		7.20
1923	6.15	6.06	6.23	8.96	8.30	8.90	6.98
1924	5.22	5.27	4.58	7.19	7.11	6.97	5.84
1925	4.75	4.95	4.56	6.90	6.56	6.87	5.70
1926	5.10	4.89	4.58	6.84	6.44	7.39	5.84
1927	4.72	5.03	4.17	6.99	6.16	6.83	5.76
1928	4.45	4.59	4.22	6.25	5.89	6.20	5.44
1929	4.31	4.63	3.72	6.27	5.10	6.23	5.28

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[1] No data.

To trace the relative growth of the several uses, however, the analysis must be carried one step further. Although Table 42 is an accurate summary of the reports made by the operating companies it is difficult to interpret because of the large and fluctuating tonnage reported as "used by the producer." Table 43 continues the analysis by grouping this tonnage with the sales of furnace coke on the assumption that the total for the two items is the best available barometer of the trend of demand for furnace coke. Actually the total thus obtained is somewhat in excess of the tonnage charged in iron blast furnaces, as previously given in Table 38. In 1929, for example, the total of "sales for furnace use" and "used by producer" was 46,785,722 tons, while the quantity charged in iron blast furnaces was 43,720,000 tons, a difference of 3,065,722 tons. Similar differences between the two sets of figures occur in other years. The excess of the figures in Table 43 is due to three causes: (1) Table 43 covers furnace coke exported to Canada and other countries, which, of course, is not included in the record of consumption by American iron furnaces; (2) a considerable part of the sales of furnace coke goes for purposes other than making iron, such, for example, as the smelting of other metals; and (3) the tonnage used by the producer is not all charged in blast furnaces but includes some coke consumed in other ways, either as fuel about the steel works or in other associated enterprises, such as the manufacture of alkalies, city gas, etc. No record of the tonnage used by producers for these other purposes was obtained before 1926, when 429,000 tons of by-product coke and 26,000 tons of beehive coke were so used. The amount is increasing with the growing number of coke plants making city gas and in 1929 was 1,285,771 tons of by-product coke and 31,802 tons of beehive coke.

With these reservations, the first column of Table 43 may be used as a rough measure of the trend of the demand for furnace coke. In 1915 the demand, calculated in this way and including both beehive and by-product coke, was about 36,703,000 tons and in 1916 about 47,875,000 tons. (Note, however, that the figures for these two years do not include the exports.) In 1918, including the exports, the demand for furnace coke was 50,002,988. In 1929, as already mentioned, it was 46,785,722 tons, an increase over 1915 but a decrease compared with either 1916 or 1918. On the whole, therefore the demand for furnace coke during this period shows no consistent increase. (See fig. 24.)

The sales of foundry coke, including both beehive and by-product coke, were 1,665,000 tons in 1915 and 2,680,000 tons in 1916, but as the figures for these two years do not include exports they are not strictly comparable with those for the rest of the period. In 1918 the total sales of foundry coke, including the exports, were 3,861,000 tons; in comparison, the sales of 2,888,508 tons in 1929 show a decrease. The figures are not to be taken as an exact measure of the trend of consumption of coke by iron foundries because, as already noted, coke of foundry grade is sometimes sold for other uses and because some of the product formerly reported as "foundry coke" may now be reported as "sold for other industrial use." As it stands the record fails to show any consistent increase in the demand for coke in this quarter.

In contrast with the stationary demand for metallurgical coke the quantities sold for domestic and miscellaneous industrial uses have increased three to four fold during the same period. Total sales for domestic and miscellaneous industrial uses in 1916, including both beehive and by-product coke but excluding the small amount exported, were 2,616,000 tons. In 1918, including the exports, they were 2,748,000 tons, from which they increased to 9,846,000 in 1929.

Beginning with 1923 the miscellaneous industrial sales were reported separately from the sales for domestic purposes, and the growth of the domestic demand can be measured exactly. In 1923, a year when supplies of anthracite were limited, the sales of coke for domestic purposes, including beehive coke, totaled 2,733,000 tons. In 1929 they were 7,511,000 tons. (An approximation of sales of by-product coke for domestic use from 1918 to 1922 is developed in Coke and By-Products in 1922, page 734. The figures are 1,408,000 tons in 1918, 1,332,000 in 1919, 1,733,000 in 1920, 1,038,000 in 1921, and 2,139,000 in 1922. Although these figures are not strictly comparable with those for later years the discrepancy is not serious. The trend for the entire period, 1918 to 1929, is shown graphically in fig. 25.)

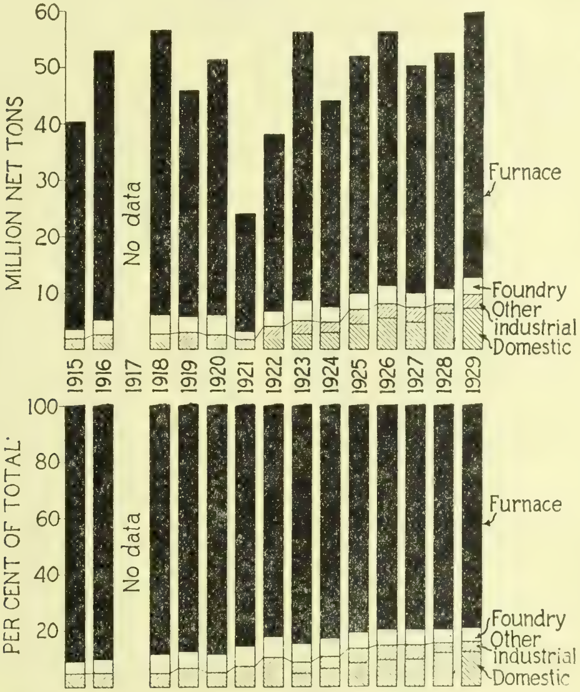

FIGURE 24.—By-product and beehive coke sold for furnace, foundry, other industrial, and domestic use. Data from Table 42. Figures for furnace coke include all coke used by producer and not sold. The data represent the disposition made of the total production, including the exports, except that in 1915 and 1916 the exports are not included

TABLE 43.—*Recapitulation of total supply of coke classified as furnace, foundry, other industrial, and domestic, 1915–1929, in net tons* [1]

[Exclusive of screenings and breeze]

Year	Furnace (including all coke used by producer) [2]	Foundry	Other industrial and domestic			Total sold and used by producer [3]
			Other industrial (not including coke used by producer)	Domestic	Total	
By-product:						
1918	21,901,043	1,631,052	(4)	(4)	2,537,059	26,069,154
1919	22,444,563	1,480,516	(4)	(4)	2,885,270	26,810,349
1920	26,903,425	1,715,982	(4)	(4)	2,361,737	30,981,144
1921	16,063,714	736,391	(4)	(4)	1,679,911	18,480,016
1922	24,041,747	1,601,733	(4)	(4)	3,865,751	29,509,231
1923	30,829,347	1,897,955	1,638,226	2,637,518	4,275,744	37,003,046
1924	27,949,972	1,553,849	1,556,175	2,812,771	4,368,946	33,872,767
1925	32,601,679	1,833,372	2,072,635	4,085,068	6,157,703	40,592,754
1926	35,028,461	2,168,017	1,662,837	5,056,568	6,719,405	43,915,883
1927	34,613,722	1,938,653	2,022,838	4,702,529	6,725,367	43,277,742
1928	38,727,993	1,955,294	1,318,629	6,254,382	7,573,011	48,256,298
1929	41,862,839	2,114,690	1,693.223	7.376,320	9,069,543	53,047,072
Beehive:						
1918	28,101,945	2,230,156	(4)	(4)	210,511	30,542,612
1919	17,598,092	1,349,483	(4)	(4)	143,930	19,091,505
1920	18,393,698	1,807,256	(4)	(4)	192,142	20,393,096
1921	4,453,190	1,011,343	(4)	(4)	56.874	5,521,407
1922	7,176,889	1,164,716	(4)	(4)	179,670	8,521,275
1923	16,945,061	1,702,764	645,662	95,896	741,558	19,389,383
1924	8,513,474	1,363,952	260,046	139,886	399,932	10,277,358
1925	9,408,655	1,153,665	572,949	392,698	965,647	11,527,967
1926	9,991,099	1,163,660	963,797	386,045	1,349,842	12,504,601
1927	5,703,408	809,590	569,749	111,103	680,852	7,193,850
1928	3,224,343	755.312	445,745	78,338	524,083	4,503,738
1929	4,922,883	773,818	641,776	134,703	776,479	6,473,180
Total:						
1915 [5]	36.702,573	1,664,548	(4)	(4)	1,974,102	40,341,223
1916 [5]	47,875,153	2,680,104	(4)	(4)	2,616,320	53,171,577
1918	50,002,988	3,861,208	(4)	(4)	2,747,570	56,611,766
1919	40,042,655	2,829,999	(4)	(4)	3,029,200	45,901,854
1920	45,297,123	3,523,238	(4)	(4)	2,553,879	51,374,240
1921	20,516,904	1,747,734	(4)	(4)	1,736,785	24,001,423
1922	31,218,636	2,766,449	(4)	(4)	4,045,421	38,030,506
1923	47,774,408	3,600,719	2,283,888	2,733,414	5,017,302	56,392,429
1924	36,463,446	2,917,801	1,816,221	2,952,657	4,768,878	44,150,125
1925	42,010,334	2,987,037	2,645,584	4,477,766	7,123,350	52,120,721
1926	45,019,560	3,331,677	2,626,634	5,442,613	8,069,247	56,420,484
1927	40,317,130	2,748,243	2,592,587	4,813,632	7,406,219	50,471,592
1928	41,952,336	2,710,606	1,764,374	6,332,720	8,097,094	52,760,036
1929	46,785,722	2,888,508	2,334,999	7,511,023	9,846,022	59,520,252

[1] For 1915 and 1916 separate figures for by-product and beehive coke are not available; the total, however, is shown. For 1917 no data on this subject were collected.

[2] Sales of furnace coke plus the total quantity reported "used by producer" includes coke consumed at associated iron and steel works for other than blast-furnace use and also a small quantity consumed for purposes that have no relation to the manufacture of iron and steel, such as alkali manufacture, smelting nonferrous metals, and making water gas and producer gas at plants supplying gas for city distribution. The quantity used for these other purposes in 1929 was 1,285,771 tons of by-product coke and 31,802 tons of beehive coke.

[3] These figures represent the quantity distributed in the year without taking into account changes in producers' stocks and therefore differ slightly from the published totals of production. In 1915 and 1916, moreover, they do not include the quantity exported.

[4] "Other industrial" and "domestic" were not reported separately prior to 1923. An approximation of the tonnage of by-product coke used for household purposes is developed in Coke and By-Products in 1922, p. 734.

[5] Figures for 1915 and 1916 do not include exports and hence are not strictly comparable with other years.

DOMESTIC COKE

The rapid increase in the use of coke for house fuel when the demand for metallurgical coke shows no consistent growth is reflected in widespread interest in the possibilities of the domestic market.

It is seldom realized that in the aggregate the consumption of fuel for heating buildings is the largest single item in the national demand for energy, exceeding even the requirements of the railroads. The total consumption of fuel for domestic purposes is equivalent to 163,000,000 tons of coal a year. This figure includes fuel for heating large buildings other than factories, and it includes the coal equivalent of oil and gas. Of this enormous total 27,000,000 tons is the equivalent of liquid or gas and 136,000,000 tons is solid fuel. The elements making up the total are shown graphically in Figure 47 of Coke and By-Products in 1928.

The domestic market is not only large, but it is growing. The increase is due partly to the growth of population; but per capita consumption is also increasing, having grown about 20 per cent in the last 20 years.

As a consumer the householder is naturally conservative, and in the past domestic demand has been slow to change; but the tendencies toward mechanization and the interplay of competition, which are increasingly conspicuous in other business, have made their appearance in the field of domestic heating as well. The domestic market now shows three distinct tendencies: An increasing proportion of the population is living and working in large buildings that can readily be heated by central heating installations; there is an increasing demand for fuels that will not smoke; and, perhaps most important, the consumer is beginning to appreciate the luxury of automatic heating with oil, gas, and small automatic stokers adapted to solid fuels. Special data on the domestic fuel market will be found in Coke and By-Products in 1928, pages 753–760, and in Anthracite in 1929.

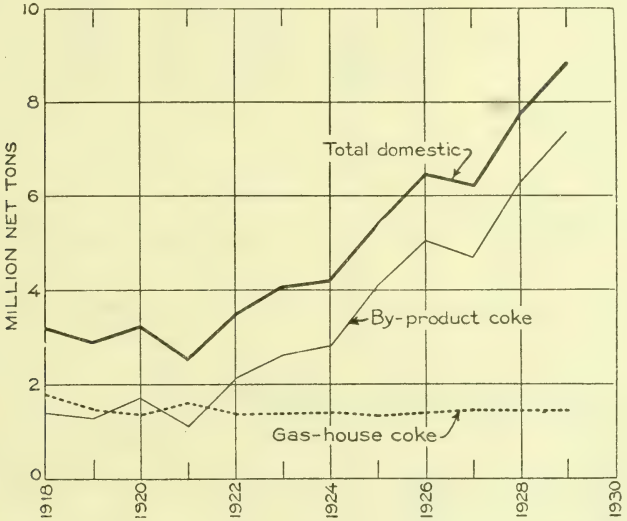

FIGURE 25.—Growth of sales of domestic by-product coke and gas-house coke, 1918–1929

The competitive nature of the domestic market is indicated by the figures in Table 44, which show the supplies of the several fuels available for or actually used for domestic purposes in the last six years.

TABLE 44.—*Total supplies of fuels used for domestic purposes in the United States, 1924–1929*

[The figures for 1925 and 1926 were affected by the great strike of the anthracite miners which lasted from September 1, 1925, to February 18, 1926]

	1924	1925	1926	1927	1928	1929
Solid fuels (net tons)						
Pennsylvania anthracite production:						
Shipments of domestic sizes	56, 576, 296	38, 305, 222	54, 096, 437	48, 999, 058	46, 218, 403	46, 141, 575
Shipments of buckwheat No. 1 [1]	9, 510, 508	6, 631, 604	8, 581, 966	9, 062, 977	8, 769, 923	8, 597, 053
Shipments of smaller steam sizes	11, 160, 695	8, 831, 546	12, 640, 417	12, 433, 251	11, 499, 274	10, 555, 951
Local sales	3, 043, 939	2, 884, 577	2, 687, 411	3, 046, 770	3, 184, 825	3, 233, 023
Total commercial production	80, 291, 438	56, 652, 949	78, 006, 231	73, 542, 056	69, 672, 425	68, 527, 602
Anthracite exported	4, 017, 785	3, 179, 006	4, 029, 683	3, 325, 507	3, 336, 272	3, 406, 369
Anthracite imported, chiefly from United Kingdom	117, 951	382, 894	813, 956	119, 030	384, 707	487, 172
Fuel briquets produced	580, 470	839, 370	995, 332	970, 468	947, 423	1, 212, 415
Fuel briquets imported	38	6, 758	123, 593	60, 601	71, 485	89, 458
By-product coke sold for domestic use	2, 812, 771	4, 085, 068	5, 056, 568	4, 702, 529	6, 254, 382	7, 376, 320
Beehive coke sold for domestic use	139, 886	392, 698	386, 045	111, 103	78, 338	134, 703
Coke imported	82, 833	201, 579	284, 548	168, 859	147, 701	119, 724
Gas-house coke sold [2]	[3] 1,400, 000	1, 368, 704	[3] 1,400, 000	1, 484, 268	1, 450, 000	1, 400, 000
Petroleum coke produced [4]	761, 100	991, 000	995, 300	1, 145, 200	1, 426, 600	1, 820, 600
Anthracite and semianthracite produced outside of Pennsylvania	704, 513	786, 594	843, 125	651, 869	712, 406	842, 313
Bituminous coal for domestic use [5]	([6])	([6])	([6])	([6])	([6])	([6])
Oil (barrels) [7]						
Oil used for heating houses	2, 800, 000	5, 000, 000	9, 080, 000	11, 709, 000	[8] 14,271, 556	17, 640, 556
Oil used for heating offices, hotels, apartments, schools, hospitals, and buildings other than houses	([9])	[10] 12, 100, 000	13, 874, 000	15, 751, 000	[8] 16,427, 105	17, 692, 851
Gas (million cubic feet)						
Natural gas consumed for domestic use	285, 152	272, 146	289, 175	296, 036	320, 877	359, 853
Manufactured gas sold for domestic purposes	([9])	([9])	([9])	[11] 281, 044	([9])	([9])

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[1] A considerable part of the buckwheat No. 1 is used for domestic purposes.

[2] See Table 4. Figures for 1928 and 1929 subject to revision.

[3] Estimated by interpolation.

[4] How much petroleum coke was used for house fuel prior to 1928 is not known. For that year 235,000 tons was reported to have been consumed for domestic heating, according to E. B. Swanson in Economic Paper 9, Bureau of Mines.

[5] During the anthracite strike of 1925–26 about 17,000,000 tons of bituminous coal in addition to the normal consumption was used to replace anthracite.

[6] Between 56,000,000 and 77,000,000 tons a year.

[7] Based upon surveys by E. B. Swanson, U. S. Bureau of Mines.

[8] Revised since last report.

[9] No data.

[10] Partly estimated.

[11] From Census of Manufactures.

Active competition between the several fuels is tending to force down prices. (See fig. 26.) Prices of fuel briquets, low-volatile bituminous coal, Pennsylvania anthracite, and the anthracite and semianthracites of other States are all moving downward. The decline in prices of domestic by-product coke in recent years has been still more pronounced, although in 1929, under the stimulus of the general activity of business, the price recovered slightly. On the other hand, prices of domestic burning oil increased slightly in 1929. Details are given in Table 45.

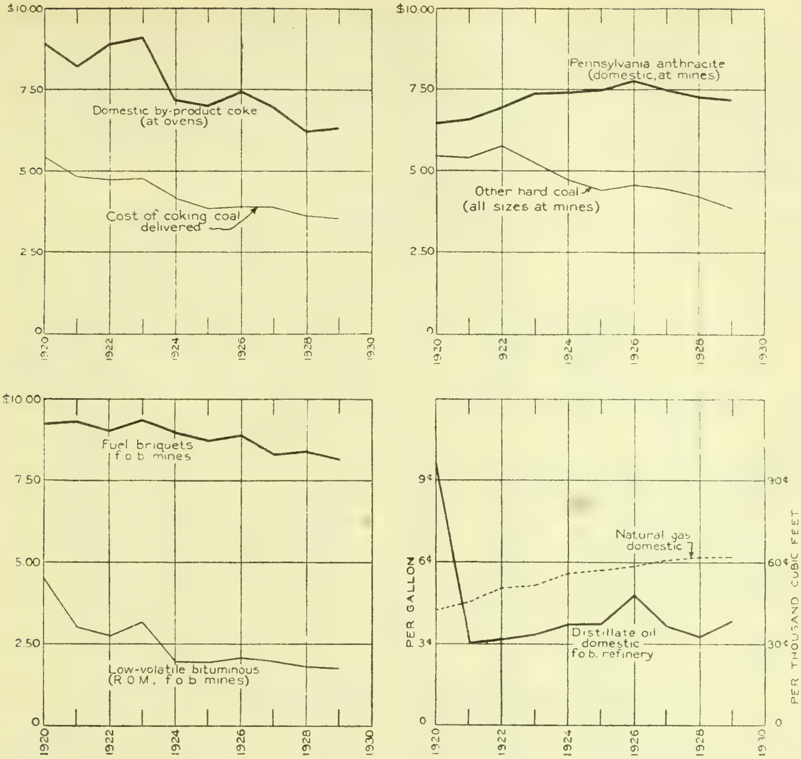

FIGURE 26.—Price trends of domestic fuels, 1920–1929. As the figures are not retail prices, they do not show comparative costs to the consumer, but they do indicate the general movement of prices. Prices of solid fuels are all per net ton, including anthracite. For data, see Table 44

TABLE 45.—*Price trends of domestic by-product coke and of other fuels suitable for household use, 1922–1929*

	Unit	Average price per unit							
		1922	1923	1924	1925	1926	1927	1928	1929
By-product coke, f. o. b. ovens:									
Sales for domestic and miscellaneous industrial use [1]	Net ton	$8.90	$9.06	$7.31	$7.04	$7.42	$6.88	$6.29	$6.18
Sales for domestic use	do	(1)	9.05	7.13	6.98	7.43	6.90	6.23	6.28
Domestic anthracite, f. o. b. mines Pennsylvania, average realization on breaker shipment [2]	Gross ton	7.77	8.23	8.25	8.30	8.66	8.33	8.09	8.00
Fuel briquets, Central States, f. o. b plants	Net ton	9.02	9.35	9.00	8.72	8.86	8.30	8.38	8.13
Cost of coking coal delivered at by-product plants	do	4.73	4.76	4.13	3.86	3.88	3.87	3.57	3.50
Low-volatile bituminous coal, f. o. b. mines [3]	do	2.74	3.16	1.96	1.90	2.04	1.93	1.75	1.73
Hard coal produced outside Pennsylvania, f. o. b. mines [4]	do	5.75	5.34	4.70	4.41	4.57	4.46	4.19	3.84
Oil, distillate for domestic heating, f. o. b. refinery [5]	Gallon	(6)	.033	.037	.037	.048	.036	.032	.038
Natural gas, domestic use, at point of consumption	M cu. ft.	.499	.514	.540	.560	.584	.608	.620	.620

[1] Until 1923 the sales for miscellaneous industrial use (a small item) were combined with those for domestic use.

[2] Includes pea and all larger sizes.

[3] Average (unweighted) of the average sales realization of operators in McDowell, Mercer, and Raleigh Counties, W. Va.

[4] Includes anthracite and semianthracite from Colorado, New Mexico, Arkansas, and Virginia.

[5] 38–40 straw distillate, Oklahoma—from Nat. Petroleum News.

[6] No data.

The place of coke in the domestic fuel market is still unimportant. The total sales of coke of all kinds for domestic use amounted to about 9,200,000 tons in 1929, hardly 5 per cent of the domestic fuel budget of the country. Table 46 classifies this total by kind of coke and type of producing interest.

The rapid growth of by-product oven coke for domestic use is shown in Figure 25.

TABLE 46.—*Coke sold for domestic use classified by type of producing interest, 1928 and 1929*

Type of producing interest	Net tons sold		Average value at plant	
	1928	1929	1928	1929
Beehive oven coke	78,338	134,703	$3.78	$3.71
By-product oven coke:				
Plants affiliated with iron furnaces	1,543,801	1,678,137	[1] 5.48	5.02
Plants engaged largely in supplying gas for city distribution, frequently public utilities	2,543,533	3,307,341	7.59	7.20
Other merchant plants	2,167,048	2,390,842	5.17	5.88
Total by-product coke	6,254,382	7,376,320	6.23	6.28
Gas-house coke, including all types of carbonizing equipment other than by-product coke ovens [1]	1,450,000	1,400,000	(2)	(2)
Petroleum coke	235,000	(2)	(2)	(2)

[1] Includes sales for all purposes, most of which were doubtless domestic. Figures estimated.
[2] No data.

THE RETAIL DEALER AS A DISTRIBUTOR OF COKE

The policy of coke producers with respect to retailing differs widely. Some companies have found it necessary to develop their own retail departments; others have utilized established retailers with success. So fortunate has this policy been in some localities that individual retailers report as much as 60 per cent of their total sales as coke. For the country as a whole, however, coke still forms a small part of the business of the typical retail coal merchant. Table 47, compiled by H. O. Rogers from reports of representative retailers, shows that for the country as a whole 61.3 per cent of the total tonnage passing through dealers' yards consisted of bituminous coal, 35.5 per cent was anthracite, and only 3.2 per cent was coke. The proportion of coke in the total varied widely in different parts of the country. It was highest in the upper Mississippi Valley, particularly in the Lake States. In only three States, Wisconsin, Michigan, and Minnesota, did coke form more than 6 per cent of the total tonnage handled by retail dealers.

TABLE 47.—*Relative proportions of coke, anthracite, and bituminous coal in the deliveries made by 875 representative dealers*

[The figures cover a selected list of retailers who handle about 20 per cent of the total retail trade. They cover four periods of two months each, namely, August–September, 1929, November–December, 1929, February–March, 1930, and May–June, 1930. Figures for coke include retort coke and possibly some beehive oven coke]

	Total of 4 stock surveys (net tons delivered to consumers)				Per cent of total		
	Bituminous	Anthracite	Coke	Total	Bituminous	Anthracite	Coke
1. New England	2,205,668	1,589,344	61,961	3,856,973	57.2	41.2	1.6
Maine	214,308	119,015	7,559	340,882	62.9	34.9	2.2
New Hampshire	119,273	45,505	2,970	167,748	71.1	27.1	1.8
Vermont	20,060	51,294	1,564	72,918	27.5	70.3	2.1
Massachusetts	1,237,990	996,779	38,668	2,273,437	54.5	43.8	1.7
Rhode Island	413,445	129,151	6,584	549,180	75.3	23.5	1.2
Connecticut	200,592	247,600	4,616	452,808	44.3	54.7	1.0
2. Middle Atlantic	1,830,645	4,971,143	165,868	6,967,656	26.3	71.3	2.4
New York	527,647	3,868,537	131,220	4,527,404	11.7	85.4	2.9
New Jersey	49,942	342,954	3,477	396,373	12.6	86.5	.9
Eastern Pennsylvania	96,604	537,511	1,684	635,799	15.2	84.5	.3
Western Pennsylvania	664,024	13,732	27,726	705,482	94.1	1.9	3.9
Delaware	9,880	23,669	47	33,596	29.4	70.5	.1
Maryland	133,725	85,754	1,272	220,751	60.6	38.8	.6
District of Columbia	348,823	98,986	442	448,251	77.8	22.1	.1
3. Ohio	780,522	19,115	23,995	823,632	94.8	2.3	2.9
4. Southern Michigan	645,140	82,916	96,415	824,471	78.2	10.1	11.7
5. Illinois and Indiana	3,189,146	215,518	134,209	3,538,873	90.1	6.1	3.8
Illinois	2,764,475	208,321	115,008	3,087,804	89.5	6.7	3.7
Indiana	424,671	7,197	19,201	451,069	94.1	1.6	4.3
6. Lower Missouri Valley	907,003	24,818	29,138	960,959	94.4	2.6	3.0
Missouri	436,164	11,528	17,823	465,515	93.7	2.5	3.8
Iowa	395,845	10,564	8,334	414,743	95.4	2.5	2.0
Nebraska	65,372	2,051	2,881	70,304	93.0	2.9	4.1
Kansas	9,622	675	100	10,397	92.5	6.5	1.0
7. Lake Dock Territory	773,504	115,631	97,665	986,800	78.4	11.7	9.9
Wisconsin	343,939	62,749	41,120	447,808	76.8	14.0	9.2
Northern Michigan	50,722	5,941	4,143	60,806	83.4	9.8	6.8
Minnesota	316,551	43,673	51,236	411,460	76.8	10.6	12.5
North Dakota	22,540	967	841	24,348	92.6	3.0	3.5
South Dakota	39,752	2,301	325	42,378	93.8	5.4	.8
8. Southeast	1,210,779	28,772	10,231	1,249,782	96.9	2.3	.8
West Virginia	38,292	281	30	38,603	99.2	.7	.1
Virginia	140,671	21,206	981	162,858	86.4	13.0	.6
North Carolina	68,400	3,388	362	72,150	94.8	4.7	.5
South Carolina	36,218	228	659	37,105	97.6	.6	1.8
Georgia	260,896	86	347	261,329	99.8	(1)	.1
Florida	9,883	2,577	634	13,094	75.5	19.7	4.8
Kentucky	326,474	490	804	327,768	99.6	.1	.2
Tennessee	225,206	200	4,470	229,876	98.0	.1	1.9
Alabama	76,025	296	1,937	78,258	97.1	.4	2.5
Mississippi	28,714	20	7	28,741	99.9	.1	(1)
9. Southwest, Mountain, and Pacific	649,348	17,719	8,380	675,447	96.1	2.6	1.2
Louisiana	163,606	784	1,096	165,486	98.9	.5	.7
Arkansas	4,204	462	66	4,732	88.8	9.8	1.4
Oklahoma	4,097	28	--------	4,125	99.3	.7	--------
Texas	4,624	169	21	4,814	96.1	3.5	.4
New Mexico	48,596	10,383	--------	58,979	82.4	17.6	--------
Arizona	6,640	427	--------	7,067	94.0	6.0	--------
Colorado	147,564	3,157	1,089	151,810	97.2	2.1	.7
Utah	46,484	--------	2,070	48,554	95.7	--------	4.3
Nevada	2,819	--------	--------	2,819	100.0	--------	--------
Wyoming	5,750	--------	--------	5,750	100.0	--------	--------
Montana	44,790	--------	--------	44,790	100.0	--------	--------
Idaho	57,008	400	3,611	61,019	93.4	.7	5.9
Washington	53,419	266	28	53,713	99.5	.5	.1
Oregon	26,863	--------	66	26,929	99.8	--------	.2
California	32,884	1,643	333	34,860	94.3	4.7	1.0
Total, United States	12,191,755	7,064,976	627,862	19,884,593	61.3	35.5	3.2

[1] Less than one-tenth of 1 per cent.

STOCKS OF COKE

With the growth of the domestic trade the problem of storing the coke at producers' plants becomes increasingly important, especially during the spring and summer. Table 48 gives details of the total quantity of coke and breeze on hand at all coke plants on January 1, 1930. On that date the by-product plants reported a total of 931,654 tons of furnace coke and 1,256,612 tons of domestic coke. Table 49 gives comparative figures of the total on hand back to 1924. The stocks of coke on hand at producers' plants, by months during 1928 and 1929, are given in Table 50. (See also fig. 27.) As might be expected, it is shown that the furnace plants carry relatively steady stocks and that the stocks of merchant plants fluctuate sharply with the season. In comparing present stocks with those in the past it must be remembered that stocks tend to increase with the natural growth of the industry. Each new by-product plant adds its quota to the quantity of coke on hand. This element of growth is eliminated in Table 51, which shows the stocks at a group of 21 identical plants that have reported at intervals since January 1, 1922.

TABLE 48.—*Stocks of furnace and foundry coke, of domestic coke, and of breeze on January 1, 1930, by States, in net tons*

[Based on complete reports from all producers]

State	Coke			Total coke	Breeze
	Furnace	Foundry	Domestic and other		
By-product plants:					
Alabama	551, 352	4, 271	77, 597	633, 220	61, 792
Colorado	36, 320	53		36, 373	135
Illinois	22, 737	2, 071	263, 109	287, 917	146, 261
Indiana	21, 312	408	52, 704	74, 424	46, 221
Maryland	7, 465	12		7, 477	19, 619
Massachusetts	14, 290	13, 899	67, 647	95, 836	14, 116
Michigan	1, 383	1, 882	91, 018	94, 283	13, 820
Minnesota	(¹)		[1] 106, 572	106, 572	14, 328
New Jersey			87, 453	87, 453	5, 005
New York	[2] 42, 257	(²)	144, 750	187, 007	34, 227
Ohio	84, 081	3, 526	99, 425	187, 032	88, 508
Pennsylvania	80, 260		67, 927	148, 187	33, 015
Tennessee	350		1, 147	1, 497	7, 285
Utah	4, 170		11, 795	15, 965	25, 277
Washington			4, 885	4, 885	
West Virginia	[2] 65, 677	(²)	22, 134	87, 811	22, 873
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin		821	158, 449	159, 270	14, 162
	931, 654	26, 943	1, 256, 612	2, 215, 209	546, 644
Beehive plants:					
Colorado	1, 236			1, 236	
Pennsylvania	23, 034	6, 022	7, 656	36, 712	137, 224
Tennessee	3, 798	458		4, 256	
Utah		416		416	
Virginia	1, 087	70		1, 157	20
West Virginia	976	963		1, 939	
	30, 131	7, 929	7, 656	45, 716	137, 244

[1] A small amount of furnace coke is included with domestic and other.

[2] A small amount of foundry coke is included with furnace.

TABLE 49.—*Summary of total stocks of coke on hand at all by-product and beehive plants at the first of the year, 1924–1930*

	Jan. 1, 1924	Jan. 1, 1925	Jan. 1, 1926	Jan. 1, 1927	Jan. 1, 1928	Jan. 1, 1929	Jan. 1, 1930
By-product plants:							
Furnace	748, 375	555, 080	367, 691	532, 831	627, 869	750, 318	931, 654
Foundry	76, 077	50, 794	22, 953	37, 414	29, 371	24, 426	26, 943
Domestic and other	(1)	880, 386	263, 923	697, 135	1, 156, 991	1, 018, 205	1, 256, 612
Total	(1)	1, 486, 260	654, 567	1, 267, 380	1, 814, 231	1, 792, 949	2, 215, 209
Beehive plants:							
Furnace	81, 346	59, 017	37, 435	25, 425	54, 441	38, 446	30, 131
Foundry	7, 620	12, 507	6, 938	6, 890	13, 615	8, 020	7, 929
Domestic and other	(1)	2, 897	7, 180	6, 446	4, 147	8, 511	7, 656
Total	(1)	74, 421	51, 553	38, 761	72, 203	54, 977	45, 716
Total:							
Furnace	829, 721	614, 097	405, 126	558, 256	682, 310	788, 764	961, 785
Foundry	83, 697	63, 301	29, 891	44, 304	42, 986	32, 446	34, 872
Domestic and other	(1)	883, 283	271, 103	703, 581	1, 161, 138	1. 026, 716	1, 264, 268
Total	(1)	1, 560, 681	706, 120	1, 306, 141	1, 886, 434	1, 847, 926	2, 260, 925

[1] Data not available.

TABLE 50.—*Total stocks of coke on hand at all furnace and nonfurnace by-product plants on the first of each month, 1928 and 1929*

[Includes furnace, foundry, and domestic, but not breeze]

Date	Furnace plants		Other plants		Total	
	1928	1929	1928	1929	1928	1929
Jan. 1	646, 975	768, 554	1, 167, 256	1, 024, 395	1, 814, 231	1, 792, 949
Feb. 1	689, 595	633, 845	1, 106, 394	734, 411	1, 795, 989	1, 368, 256
Mar. 1	713, 497	597, 601	1, 002, 894	459, 858	1, 716, 391	1, 057, 459
Apr. 1	748, 460	636, 517	955, 121	576, 045	1, 703, 581	1, 212, 562
May 1	769, 815	660, 881	939, 152	678, 490	1, 708, 967	1, 339, 371
June 1	750, 479	723, 811	1, 001, 063	703, 777	1, 751, 542	1, 427, 588
July 1	758, 260	780, 928	1, 094, 849	833, 035	1, 853, 109	1, 613, 963
Aug. 1	761, 850	779, 617	1, 175, 041	1, 069, 303	1, 936, 891	1, 848, 920
Sept. 1	746, 225	846, 769	1, 246, 876	1, 253, 349	1, 993, 101	2, 100, 118
Oct. 1	729, 749	915, 080	1, 177, 119	1, 314, 566	1, 906, 868	2, 229, 646
Nov. 1	732, 308	940, 963	1, 062, 752	1, 260, 054	1, 795, 060	2, 201, 017
Dec. 1	732, 690	954, 718	1, 058, 970	1, 314, 079	1, 791, 660	2, 268, 797

TABLE 51.—*Total stocks of coke at 21 identical by-product coke plants supplying gas for city use, 1922–1929, in net tons*

1922	
Jan. 1	1, 017, 000
Mar. 1	987, 000
Oct. 1	250, 000
Nov. 1	228, 000
1923	
Jan. 1	212, 000
Feb. 1	146, 000
Mar. 1	92, 000
June 1	202, 000
July 1	308, 000
Aug. 1	430, 000
Sept. 1	501, 000
Oct. 1	476, 000
1924	
Jan. 1	772, 000
Sept. 1	1, 114, 000
1925	
Mar. 1	631, 000
June 1	722, 000
Sept. 1	865, 000
Nov. 1	623, 000
1926	
Jan. 1	248, 000
Feb. 1	90, 000
Apr. 1	53, 000
May 1	151, 000
July 1	334, 000
Aug. 1	470, 000
Oct. 1	628, 000
Nov. 1	579, 000
1927	
Jan. 1	516, 000
Feb. 1	353, 000
Apr. 1	470, 000
May 1	560, 000
July 1	584, 000
Aug. 1	705, 000
Oct. 1	799, 000
1928	
Jan. 1	787, 000
Feb. 1	749, 000
Apr. 1	750, 000
May 1	787, 000
July 1	879, 000
Aug. 1	952, 000
Oct. 1	959, 000
Nov. 1	806, 000
1929	
Jan. 1	883, 000
Feb. 1	623, 000
Mar. 1	383, 000
Apr. 1	480, 000
May 1	537, 000
June 1	530, 000
July 1	600, 000
Aug. 1	703, 000
Sept. 1	810, 000
Oct. 1	801, 000
Nov. 1	776, 000
Dec. 1	826, 000
Dec. 31	749, 000

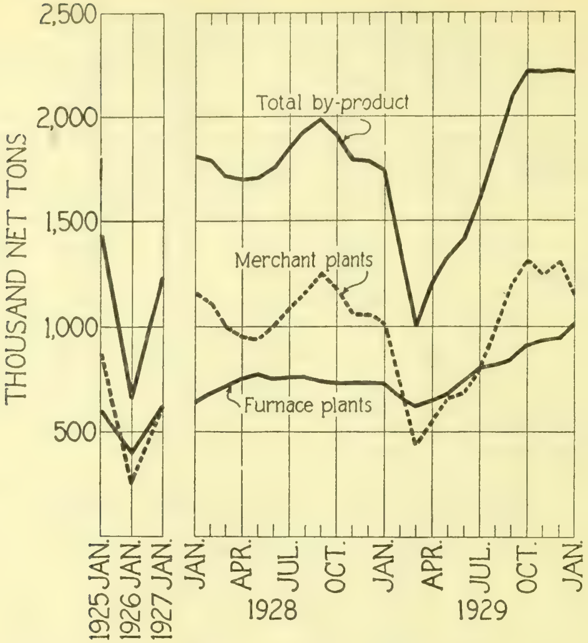

FIGURE 27.—Total stocks of by-product coke at producers' plants on the first of each month. The figures in this diagram include all by-product plants and are therefore more complete than those for the selected group of 21 identical plants whose stocks from 1922 to 1929 are shown in Figure 19

VALUE AND PRICE

TABLE 52.—*Average receipts per net ton for coke sold, by States, in 1929*

State	By-product				Beehive			
	Furnace	Foundry	Other industrial, etc.	Domestic	Furnace	Foundry	Other industrial, etc.	Domestic
Alabama	$2.73	$4.33	$3.17	$3.16	--------	--------	--------	--------
Georgia	--------	--------	--------	--------	--------	$4.55	--------	--------
Illinois	(1)	(1)	5.56	5.90	--------	--------	--------	--------
Indiana	--------	7.30	6.01	5.06	--------	--------	--------	--------
Michigan	(1)	(1)	5.86	(1)	--------	--------	--------	--------
New York	5.81	(1)	(1)	6.90	--------	--------	--------	--------
Ohio	4.77	6.93	4.18	3.89	(2)	--------	--------	--------
Pennsylvania	4.24	7.43	7.22	6.89	[2] $3.11	4.41	$2.91	$3.27
Tennessee	4.35	4.85	--------	6.90	3.46	(1)	--------	--------
Virginia	--------	--------	--------	--------	(1)	4.55	4.09	(1)
Washington	--------	--------	--------	7.00	--------	10.02	--------	--------
West Virginia	(1)	(1)	2.39	(1)	3.08	3.86	(1)	(1)
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	(1)	7.78	(1)	7.72	--------	--------	--------	--------
Undistributed [3]	5.67	7.99	6.17	7.64	5.88	7.42	3.42	6.03
	5.02	6.97	5.77	6.28	3.21	4.37	3.34	3.71

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[1] Included under "Undistributed."

[2] A small amount of beehive coke produced in Ohio is included with Pennsylvania.

[3] Includes, in addition to items indicated by footnote 1, Colorado, Maryland, Massachusetts, Minnesota, New Jersey, and Utah.

TABLE 53.—*Average value per ton of all coke produced, 1913–1929, and average receipts per ton for coke sold, 1918–1929*

Year	Value per ton produced [1]			Receipts per ton sold		
	By-product	Beehive	Total	By-product	Beehive	Total
1913	$3.83	$2.39	$2.78	(2)	(2)	(2)
1914	3.39	2.15	2.56	(2)	(2)	(2)
1915	3.45	2.07	2.54	(2)	(2)	(2)
1916	3.95	2.69	3.13	(2)	(2)	(2)
1917	6.18	4.81	5.36	(2)	(2)	(2)
1918	7.42	6.21	6.77	$7.88	$6.08	$6.52
1919	6.37	5.15	5.85	6.58	5.05	5.60
1920	10.15	7.94	9.27	10.77	7.43	8.50
1921	5.95	5.45	5.84	7.72	5.41	6.56
1922	6.59	5.84	6.42	8.45	5.79	7.20
1923	6.85	5.98	6.56	8.53	6.06	6.98
1924	5.76	4.70	5.51	6.90	4.63	5.84
1925	5.28	4.56	5.12	6.61	4.52	5.70
1926	5.65	4.57	5.41	6.95	4.57	5.84
1927	5.29	4.20	5.13	6.57	4.15	5.76
1928	4.90	3.63	4.79	5.95	3.66	5.44
1929	4.80	3.49	4.66	5.94	3.40	5.28

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[1] Includes operators' statements of the value of coke consumed by them in associated enterprises but not sold, except that in 1918 and 1920 the value of such coke was estimated for each State at the average value for that State of the part of the product reported sold.

[2] Data not available.

TABLE 54.—*Average value per net ton of coke exported from the United States, 1900–1929*

[Computed from records of Bureau of Foreign and Domestic Commerce]

Year	Average value	Year	Average value	Year	Average value
1900	$3.22	1910	$3.10	1920	$10.87
1901	3.63	1911	3.14	1921	9.00
1902	4.06	1912	3.29	1922	8.44
1903	4.49	1913	3.35	1923	9.61
1904	3.94	1914	3.37	1924	7.47
1905	3.34	1915	3.45	1925	7.20
1906	3.21	1916	3.58	1926	7.07
1907	3.27	1917	6.06	1927	6.73
1908	3.11	1918	7.03	1928	6.74
1909	3.22	1919	7.15	1929	6.33

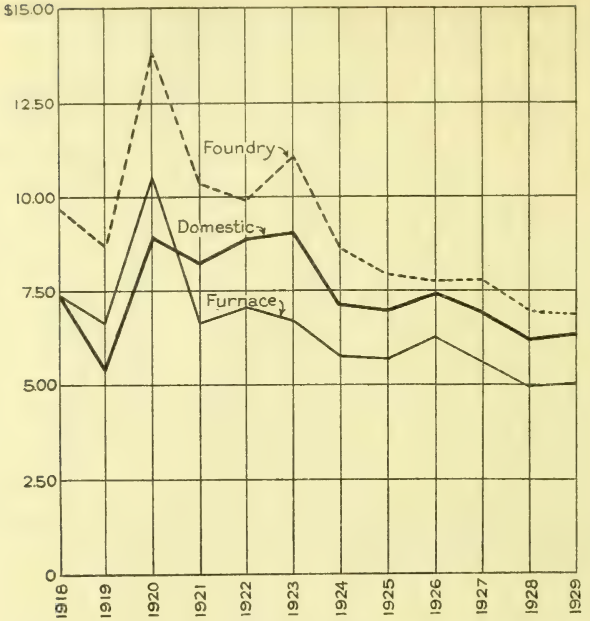

FIGURE 28.—Downward trend of coke prices. Average sales realization on sales of by-product coke for furnace, foundry, and domestic use. Note that prior to 1923 the average for domestic coke includes also sales for miscellaneous industrial use

TABLE 55.—*Average monthly prices per net ton at ovens of spot or prompt Connellsville furnace and foundry coke, 1919–1929* [1]

Month	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
FURNACE											
January	$5.65	$6.00	$5.06	$2.75	$8.05	$3.94	$3.94	$7.19	$3.50	$2.70	$2.75
February	4.44	6.00	4.50	3.04	7.13	4.08	3.63	7.31	3.38	2.68	2.90
March	4.06	6.00	4.35	3.25	7.25	4.08	3.35	3.05	3.35	2.60	2.98
April	3.65	9.60	3.50	4.48	6.31	3.75	3.04	3.00	3.20	2.60	2.78
May	3.69	12.00	3.25	6.00	5.15	3.25	3.00	2.91	2.94	2.60	2.75
June	4.00	15.00	3.00	6.75	4.75	3.19	2.77	2.83	2.93	2.60	2.75
July	4.07	17.20	2.81	10.75	4.55	3.00	2.83	2.84	3.00	2.63	2.75
August	4.31	17.75	2.75	12.80	4.56	3.00	3.06	2.95	3.00	2.75	2.73
September	4.56	16.70	3.15	11.13	4.50	3.00	3.49	3.38	2.85	2.75	2.65
October	4.52	15.12	3.28	9.60	3.85	3.00	6.13	3.63	2.85	2.83	2.65
November	5.87	8.26	3.03	7.19	3.81	3.04	5.75	4.43	2.77	2.75	2.65
December	6.12	6.20	2.75	7.00	4.00	3.68	4.32	3.50	2.75	2.75	2.64
Average	4.58	11.32	3.45	7.06	5.33	3.42	3.78	3.92	3.04	2.69	2.75
FOUNDRY											
January	6.25	7.00	6.38	3.75	8.70	4.75	4.88	7.75	4.50	3.75	3.75
February	5.00	7.00	5.63	4.00	8.25	4.88	4.31	8.31	4.31	3.75	3.75
March	4.94	7.00	5.45	4.25	8.38	4.88	4.15	4.40	4.40	3.75	3.75
April	4.30	10.20	4.75	5.06	7.56	4.75	4.00	4.06	4.06	3.75	3.75
May	4.31	13.00	4.50	6.30	6.15	4.69	4.00	4.00	4.00	3.75	3.75
June	4.56	15.75	4.45	7.25	5.56	4.38	3.80	4.00	4.00	3.75	3.75
July	5.00	17.80	4.06	11.00	5.35	4.10	3.75	4.00	4.00	3.75	3.75
August	5.25	18.88	3.75	13.90	5.38	4.00	3.88	4.00	4.00	3.75	3.75
September	5.80	17.70	4.15	12.50	5.50	4.00	4.25	4.38	4.00	3.75	3.75
October	6.25	16.38	4.38	11.70	4.80	4.00	6.31	4.63	4.00	3.75	3.75
November	7.00	9.50	4.19	8.38	4.81	4.06	6.81	5.50	3.85	3.75	3.75
December	7.00	7.00	3.81	7.88	4.81	4.55	5.20	4.50	3.75	3.75	3.75
Average	5.47	12.27	4.63	8.00	6.27	4.42	4.61	4.96	4.11	3.75	3.75

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[1] Iron Age, Jan. 2, 1930, p. 132.

TABLE 56.—*Average monthly prices of by-product foundry coke, in 10 markets, as quoted by Steel*

	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
Ashland. Ky. (at ovens): [1]													
1926	(2)	(2)	(2)	(2)	(2)	$8.00	$7.50	$7.50	$7.50	$7.50	$7.50	$8.00	(2)
1927	$8.00	$8.00	$7.50	$7.50	$7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	$7.58
1928	7.50	7.50	7.50	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.13
1929	7.00	7.13	7.63	[1] 6.56	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.69
Birmingham, Ala. (at ovens):													
1925	(2)	4.90	5.00	5.00	4.65	4.50	4.50	4.50	4.60	4.75	5.70	5.70	(2)
1926	5.60	5.50	5.50	5.15	5.15	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.45
1927	5.15	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.25	5.00	5.41
1928	5.00	5.00	5.00	3.95	4.80	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.90
1929	5.00	5.00	5.00	5.00	5.00	5 00	5 00	5 00	5 00	5.00	5.00	5.00	5.00
Buffalo, N. Y. (at ovens):													
1927	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	9.00	9.00	9.00	9.00	(2)
1928	9.00	9.00	8.65	8.50	8.50	9.00	9.00	9.00	9.00	9.00	9.00	9.00	8.89
1929	9.00	8.75	8.75	8.95	9.00	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.81
Chicago, Ill. (at ovens):													
1923	15.00	15.00	15.00	15.00	15.00	15.00	13.50	13.50	13.50	13.50	12.50	12.50	14.08
1924	12.50	12.50	12.50	12.50	12.50	12.50	11.45	10.75	10.75	10.75	10.75	10.75	11 68
1925	10.75	10.75	10.75	10.75	10.75	10.75	9.75	9.75	9.75	10.25	10.45	10.50	10.41
1926	10.50	10.50	10.50	9.95	9.75	9.75	9.75	9.75	9.75	9.75	9.75	10.25	10.00
1927	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.30	9.00	9.65
1928	9.00	9.00	9.00	9.00	9.00	8.50	8.00	8.00	8.00	8.00	8.00	8.00	8.46
1929	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Detroit, Mich. (at ovens):													
1927	(2)	(2)	(2)	(2)	(2)	(2)	(2)	9.15	9.00	9.00	9.00	9.00	(2)
1928	9.00	9.00	9.00	9.00	9.00	8.90	8.50	8.50	8.50	8.50	8.50	8.50	8.74
1929	8.50	8.65	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	8.93
Indianapolis, Ind. (delivered at consumers' works):													
1925	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	11.25	(2)
1926	11.25	11.25	11.25	10.75	10.75	10.75	10.25	10.25	10.25	10.25	10.25	10.25	10.63
1927	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	9.75	9.75	9.75	9.75	10.08
1928	9.75	9.75	9.75	8.75	8.75	8.75	8.50	8.25	8.25	8.25	8.25	8.25	8.77
1929	8.25	8.60	9.60	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.39
Newark, N. J. (delivered at consumers' works):													
1923	12.84	12.84	12.84	12.84	12.34	11.84	11.34	11.34	11.34	11.41	10.91	10.91	11.90
1924	10.91	10.91	10.91	10.81	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.57
1925	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.41	10.71	11.04	11.52	10.58
1926	11.01	11.01	11.01	9.59	9.59	9.59	9.59	9.59	9.59	9.59	10.59	10.59	10.11
1927	9.84	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.61
1928	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9 00	9.00	9.00	9.00	9.00
1929	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
New England [3] (delivered at consumers' works):													
1923	16.00	16.00	16.00	16.00	16.00	15.50	13.50	13.50	13.50	13.50	12.50	12.50	14.54
1924	12.50	12.50	12.50	12.00	12.00	11.30	11.80	11.50	11.50	11.50	11.50	11.50	11.84
1925	11.50	12.00	12.00	12.00	12.00	11.50	11.50	11.65	12.00	12.00	12.90	13.00	12.00
1926	13.00	13.00	13.00	12.50	12.50	12.00	12.00	12.00	12.00	12.00	13.00	13.50	12.54
1927	13.50	12.65	12.50	12.50	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.26
1928	11.50	11.50	11.50	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.13
1929	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
Portsmouth, Ohio (at ovens): [1]													
1926	(2)	(2)	(2)	(2)	(2)	7.50	7.50	7.50	7.50	7.40	7.90	8.00	(2)
1927	8.00	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.54
1928	7.50	7.50	7.50	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.13
1929	7.00	7.13	7.63	[1] 6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.69
St. Louis, Mo. (at ovens):													
1923	14.00	14.25	14.20	14.00	14.00	14.00	14.00	13.00	13.00	13.00	13.00	13.00	13.62
1924	12.50	12.50	12.50	12.00	12.00	10.60	9.20	9.00	9.00	9.00	9.00	9.00	10.53
1925	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.15	9.50	9.80	10.00	10.00	9.29
1926	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.25	10.50	10.06
1927	10.50	10.50	10.50	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.94
1928	9.75	9.75	9.75	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.19
1929	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00

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[1] Prices quoted at ovens, Ashland and Portsmouth, up to and including March, 1929, thereafter quoted on Connellsville ovens basis.

[2] No data.

[3] Before July, 1924, reported as "Boston, Mass., delivered at consumers' works."

SHIPMENTS BY RAIL AND WATER

Tables 57 to 59, which follow, show the quantity of by-product and beehive coke shipped by originating railroads and waterways. They are compiled from reports of the coke operators and therefore may not always agree with the records of the carriers themselves.

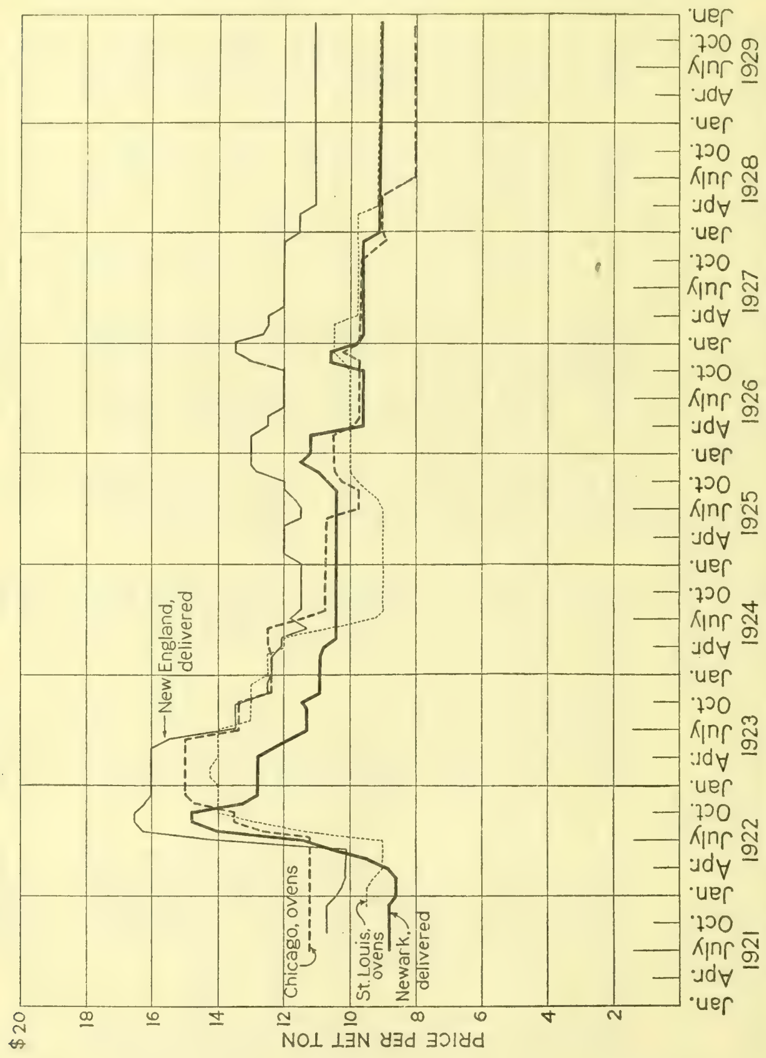

FIGURE 29.—Average monthly price of by-product foundry coke in four markets, 1921-1929, as quoted by Steel

In the by-product industry a large part of the coke produced is consumed close to the ovens and is not loaded for shipment. In 1929 shipments of by-product coke amounted to only 48.7 per cent of production. (See Table 57.) The beehive ovens, on the other hand, are usually situated at the mines, and the great bulk of the beehive coke produced must be transported some distance to reach the place of use. Table 58 indicates that in 1929, for the country as a whole, 91.7 per cent of the beehive coke produced was loaded for shipment.

In some localities, however, the furnaces that consume beehive coke are also located at the mines, and considerable quantities of the coke produced are used locally without appearing as railroad shipments. This fact is notable in the Birmingham district.

Water-borne shipments of beehive coke are practically confined to the Monongahela River, down which a comparatively small tonnage is transported from the Connellsville field to the Pittsburgh district. By-product coke moves in small quantities over several water routes, the most important being the Detroit and Monongahela Rivers and the estuaries connecting with New York Harbor.

TABLE 57.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1929, by States, as reported by the coke producers*

State	Originating railroad or waterway	Shipments (net tons)	Production (net tons)	Per cent of State production shipped
	RAILROADS			
Alabama	Birmingham Southern; Illinois Central; Louisville & Nashville; Mobile & Ohio; St. Louis-San Francisco; Seaboard Air Line; Southern; Woodward Iron Co.	2,294,325	4,753,967	48.3
Colorado	Colorado & Wyoming	14,678	565,031	2.6
Illinois	Alton & Eastern; Alton & Southern; Belt Railway of Chicago; Chicago & Illinois Western; Chicago, Milwaukee, St. Paul & Pacific; Chicago Short Line; Elgin, Joliet & Eastern; Illinois Central; Litchfield & Madison; Terminal Railroad Association.	2,555,059	4,204,116	60.8
Indiana	Cleveland, Cincinnati, Chicago & St. Louis; Chicago, Milwaukee, St. Paul & Pacific; Elgin, Joliet & Eastern; New York Central.	2,265,701	6,455,378	35.1
Maryland	Pennsylvania	7,222	1,393,052	.5
Massachusetts	Boston & Albany; Boston & Maine	609,637	776,679	78.5
Michigan	Canadian Pacific; Delray Connecting; Detroit Terminal; Detroit, Toledo & Ironton; Grand Trunk Railway System; Michigan Central; New York Central; Pennsylvania; Pere Marquette; Wabash.	1,429,607	2,679,971	53.3
Minnesota	Duluth, Missabe & Northern; Great Northern; Northern Pacific.	413,924	746,004	55.5
New Jersey	Delaware, Lackawanna & Western; Erie; Pennsylvania; Philadelphia & Reading.	185,476	897,530	20.7
New York	Buffalo, Rochester & Pittsburgh; Delaware, Lackawanna & Western; Lehigh Valley; New York Central; New York, New Haven & Hartford; South Buffalo.	1,818,949	4,299,470	42.3
Ohio	Baltimore & Ohio; Erie; Fairport, Painesville & Eastern; Lake Erie & Eastern; Lake Terminal; Newburgh & South Shore; New York Central; Nickel Plate; Norfolk & Western; Pennsylvania; Pittsburgh & Lake Erie; River Terminal; Toledo Terminal; Wheeling & Lake Erie.	2,962,491	8,521,132	34.8
Pennsylvania	Conemaugh & Black Lick; Lehigh Valley; Pennsylvania; Philadelphia & Reading; Pittsburgh & Ohio Valley; Union.	7,022,306	14,489,283	48.5
Tennessee	Nashville, Chattanooga & St. Louis; Southern.	157,289	113,285	[1] 138.8
Utah	Denver & Rio Grande Western; Union Pacific.	103,634	267,939	38.7
Washington	Northern Pacific	452	40,879	1.1
West Virginia	Baltimore & Ohio; Monongahela; Pennsylvania.	521,906	1,431,314	36.5
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin.	Chesapeake & Ohio; Chicago & North Western; Chicago, Milwaukee, St. Paul & Pacific; Minneapolis, St. Paul & Sault Ste. Marie; Missouri Pacific; New York, New Haven & Hartford.	1,328,205	1,776,796	74.7
	Total railroad shipments	23,690,861		

Excess of shipments over production represents inclusion of screenings or withdrawal from stock.

TABLE 57.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1929, by States, as reported by the coke producers*—Continued

State	Originating railroad or waterway	Shipments (net tons)	Production (net tons)	Per cent of State production shipped
	WATERWAYS			
Maryland	Chesapeake Bay	63, 162	(2)	4. 5
Michigan	Detroit River	247, 042	(2)	9. 2
New Jersey	Hackensack River	470, 293	(2)	52. 4
New York	East River; Long Island Sound	465, 163	(2)	10. 8
Connecticut, Massachusetts, and Rhode Island.	Boston Harbor; Connecticut River; Narragansett Bay.	109, 724	(2)	8. 9
Ohio, Pennsylvania, and Wisconsin.	DelawareRiver; Lake Erie; Lake Michigan; Monongahela River.	970, 329	(2)	(3)
	Total waterway shipments	2, 325, 713		
	Grand total	26, 016, 574	53, 411, 826	48. 7

[2] Figures given under respective States above.
[3] Not at liberty to publish.

TABLE 58.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States in 1929, by States, as reported by the coke producers*

State	Originating railroad or waterway	Shipments (net tons)	Production (net tons)	Per cent of State production shipped
	RAILROADS			
Colorado	Colorado & Wyoming	36, 741		
	Denver & Rio Grande Western	111, 577		
		148, 318	156, 426	94. 8
Georgia	Central of Georgia	346		
Pennsylvania [1]	Baltimore & Ohio	219, 011		
	Buffalo, Rochester & Pittsburgh	200, 345		
	Ligonier Valley	109, 310		
	Monongahela	1, 982, 189		
	Pennsylvania	1, 953, 651		
	Pittsburgh & Lake Erie	27, 346		
	Washington Run	79, 302		
		4, 571, 154	[1] 5, 367, 685	85. 2
Tennessee	Nashville, Chattanooga & St. Louis	13, 037		
	Southern	13, 199		
		26, 236	95, 881	27. 4
Utah	Denver & Rio Grande Western	14, 055	14, 055	100. 0
Virginia	Interstate	233, 990		
	Norfolk & Western	82, 770		
		316, 760	314, 859	[2] 100. 6
Washington	Northern Pacific	25, 844	25, 844	100. 0
West Virginia	Baltimore & Ohio	91, 606		
	Chesapeake & Ohio	121, 050		
	New York Central	266, 400		
	Norfolk & Western	17, 976		
	Western Maryland	1, 276		
		498, 308	497, 269	[2] 100. 2
	Total railroad shipments	5, 601, 021		
	WATERWAYS			
Pennsylvania	Monongahela River	334, 490	(3)	6. 2
	Grand total	5, 935, 511	6, 472, 019	91. 7

[1] Ohio included with Pennsylvania.
[2] Excess of shipments over production represents inclusion of screenings or withdrawal from stock.
[3] Figures given under Pennsylvania above.

TABLE 59.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States in 1929, by routes, as reported by the coke producers*

Route	State	Quantity (net tons)		Per cent of total
		By States	Total	
Railroads:				
Baltimore & Ohio	Pennsylvania	219,011	310,617	5.2
	West Virginia	91,606		
Buffalo, Rochester & Pittsburgh	Pennsylvania	200,345	200,345	3.4
Central of Georgia	Georgia	346	346	(1)
Chesapeake & Ohio	West Virginia	121,050	121,050	2.1
Colorado & Wyoming	Colorado	36,741	36,741	.6
Denver & Rio Grande Western	do	111,577	125,632	2.1
	Utah	14,055		
Interstate	Virginia	233,990	233,990	4.0
Ligonier Valley	Pennsylvania	109,310	109,310	1.9
Monongahela	do	1,982,189	1,982,189	33.4
Nashville, Chattanooga & St. Louis	Tennessee	13,037	13,037	.2
New York Central	West Virginia	266,400	266,400	4.5
Norfolk & Western	Virginia	82,770	100,746	1.7
	West Virginia	17,976		
Northern Pacific	Washington	25,844	25,844	.4
Pennsylvania	Pennsylvania	1,953,651	1,953,651	32.9
Pittsburgh & Lake Erie	do	27,346	27,346	.5
Southern	Tennessee	13,199	13,199	.2
Washington Run	Pennsylvania	79,302	79,302	1.3
Western Maryland	West Virginia	1,276	1,276	(1)
Total railroad shipments		5,601,021	5,601,021	94.4
Waterway: Monongahela River	Pennsylvania	334,490	334,490	5.6
Grand total		5,935,511	5,935,511	100.0

[1] Less than one-tenth of 1 per cent.

EXPORTS AND IMPORTS [1]

TABLE 60.—*Coke exported from the United States, 1909–1929*

Year	Net tons	Value	Year	Net tons	Value
1909	1,002,916	$3,232,673	1920	919,802	$9,993,665
1910	984,618	3,053,293	1921	306,755	2,760,939
1911	1,023,727	3,215,990	1922	511,541	4,319,538
1912	912,576	3,002,742	1923	1,237,342	11,889,897
1913	987,395	3,309,930	1924	659,350	4,926,478
1914	663,585	2,233,686	1925	953,812	6,871,962
1915	895,509	3,092,498	1926	987,260	6,979,896
1916	1,174,645	4,202,236	1927	806,664	5,430,704
1917	1,409,320	8,543,746	1928	1,097,666	7,394,531
1918	1,687,824	11,861,408	1929	1,238,035	7,840,368
1919	716,956	5,128,119			

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[1] Figures on exports and imports, unless otherwise indicated, compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

TABLE 61.—*Coke exported from the United States, 1927–1929, by customs districts*

District	1927		1928		1929	
	Net tons	Value	Net tons	Value	Net tons	Value
Alaska					1	$17
Arizona	1,317	$10,774	815	$6,548	1,038	8,421
Buffalo	320,599	2,099,257	478,075	3,034,232	627,231	4,028,991
Dakota	14,801	116,664	12,627	97,162	18,388	129,910
Duluth-Superior	2,704	21,235	3,922	25,391	3,528	20,941
El Paso	52	581	20	341	20	319
Florida	13,540	148,594	14,239	86,896	13,662	137,339
Galveston			8,543	62,850	553	3,723
Los Angeles	672	5,934	83	833	35	481
Maine and New Hampshire	3,543	26,786	3,569	27,000	3,720	27,032
Maryland	6,352	45,266	5,007	32,481	5,347	30,711
Massachusetts	4	54	6,523	44,909		
Michigan	309,534	1,986,981	447,449	3,120,416	426,771	2,448,380
Mobile	7,820	136,179	12,112	152,845	26,362	239,447
New Orleans	1,681	21,194	5,488	88,193	5,338	56,038
New York	5,884	66,673	1,329	17,611	3,035	30,122
Ohio	73,902	445,927	69,671	385,149	71,690	386,433
Philadelphia	2,801	25,431	2,064	10,015	1,163	10,568
Porto Rico	67	834	31	467	53	748
Rochester	55	341			45	311
Sabine					9,184	123,000
St. Lawrence	14,380	101,619	10,506	86,662	5,311	44,754
San Antonio	456	2,652	576	3,930	816	4,374
San Francisco	68	1,272	60	1,118	43	764
Vermont	12,928	99,478	12,105	88,756	8,574	61,565
Virginia	4,280	21,118	2,105	11,794	3,916	30,250
Washington	9,224	45,860	747	8,932	2,211	15,729
	806,664	5,430,704	1,097,666	7,394,531	1,238,035	7,840,368

TABLE 62.—*Coke exported from the United States, 1927–1929, by countries of destination*

Destination	1927		1928		1929	
	Net tons	Value	Net tons	Value	Net tons	Value
Africa (British West)	3	$68				
Australia			132	$1,239		
Belgium					336	$6,000
Bermudas			26	340		
Bolivia			22	270	45	540
Brazil	39	623			37	499
British Honduras	1	10				
Canada	764,096	4,960,696	1,044,484	6,913,605	1,170,008	7,179,895
Chile	7,896	54,103	4,445	29,127	5,667	32,931
Colombia	97	1,678	184	2,645	147	2,337
Costa Rica	66	1,408	59	774	38	651
Cuba	15,835	162,068	21,566	126,198	32,118	221,687
Dominican Republic	119	1,537	54	799	69	1,036
Ecuador	83	1,346	127	1,795	32	391
France	4,947	82,340	2,247	28,312	15,349	221,593
French Oceania	2	40	11	221	2	40
Germany	2,775	42,305	5,045	86,385	2,448	38,700
Guatemala	63	1,037	245	3,163	35	469
Haiti	44	343	30	228		
Honduras	72	1,106	91	1,349	127	1,126
Italy	896	16,000	7,709	85,809	5,422	78,490
Jamaica					1	23
Mexico	3,174	28,077	2,019	17,540	2,333	18,068
Netherlands	1,148	20,000	4,379	52,057	1,143	10,406
Netherland West Indies	10	114			22	275
Newfoundland and Labrador			58	472	75	546
Nicaragua	28	503	35	648	34	622
Norway	1,209	11,733	792	7,157		
Other British West Indies	13	158	58	550	28	275
Panama	176	3,298	320	4,724	263	2,432
Peru	1,868	11,262	2,691	14,450	218	3,618
Salvador	38	655	59	1,074	58	1,066
Sweden					1	10
Trinidad and Tobago	6	60	11	137	2	24
United Kingdom	1,734	24,506	675	12,113	1,881	14,824
Venezuela	225	3,618	92	1,350	95	1,786
Virgin Islands of the United States	1	12			1	8
	806,664	5,430,704	1,097,666	7,394,531	1,238,035	7,840,368

TABLE 63.—*Coke exported from the United States, 1927–1929, by months*

Month	1927		1928		1929	
	Net tons	Value	Net tons	Value	Net tons	Value
January	66, 608	$488, 437	72, 411	$480, 582	116, 366	$716, 605
February	66, 084	486, 946	85, 362	564, 945	85, 258	556, 513
March	52, 010	394, 948	82, 766	530, 404	97, 488	671, 613
April	55, 495	376, 163	69, 568	451, 639	67, 597	413, 243
May	56, 531	379, 721	99, 894	605, 377	93, 236	586, 506
June	65, 897	425, 232	77, 211	488, 222	102, 933	626, 328
July	65, 004	390, 342	88, 517	499, 002	93, 778	585, 948
August	61, 925	410, 372	78, 277	473, 461	96, 221	573, 834
September	85, 101	567, 065	86, 959	544, 520	109, 677	658, 707
October	77, 361	504, 224	111, 870	681, 562	141, 393	892, 903
November	84, 272	560, 811	135, 076	814, 013	109, 823	695, 743
December	70, 376	446, 443	109, 755	1, 260, 804	124, 265	862, 425
	806, 664	5, 430, 704	1, 097, 666	7, 394, 531	1, 238, 035	7, 840, 368

TABLE 64.—*Coke imported for consumption in the United States, 1909–1929*

Year	Net tons	Value	Year	Net tons	Value
1909	191, 253	$736, 120	1920	41, 143	$403, 175
1910	172, 716	625, 130	1921	30, 990	336, 394
1911	77, 923	254, 455	1922	94, 228	802, 987
1912	123, 614	488, 398	1923	85, 002	862, 596
1913	101, 212	435, 157	1924	82, 833	795, 477
1914	133, 226	551, 104	1925	201, 579	1, 609, 474
1915	53, 222	222, 382	1926	284, 548	2, 174, 350
1916	54, 955	249, 514	1927	168, 859	1, 371, 568
1917	24, 872	146, 451	1928	147, 701	1, 132, 855
1918	30, 168	221, 880	1929	119, 724	1, 092, 235
1919	16, 486	140, 653			

TABLE 65.—*Coke imported into the United States, 1927–1929, by customs districts*

District	1927		1928		1929	
	Net tons	Value	Net tons	Value	Net tons	Value
Arizona	----------	----------	----------	----------	30	$300
Buffalo	22, 658	$367, 699	22, 719	$450, 391	29, 344	534, 085
Connecticut	----------	----------	3, 201	19, 474	----------	----------
Hawaii	562	2, 535	672	4, 160	----------	----------
Los Angeles	22, 859	136, 272	25, 448	157, 816	23, 450	166, 277
Maine and New Hampshire	386	2, 865	1, 730	11, 652	459	3, 130
Michigan	50, 225	427, 819	10, 670	65, 562	2, 336	14, 585
Montana and Idaho	24, 828	178, 835	15, 948	121, 142	22, 638	170, 997
New York	36	645	8	84	189	2, 361
Ohio	37	103	----------	----------	----------	----------
Oregon	4, 395	22, 853	3, 734	16, 539	3, 549	16, 313
Philadelphia	----------	----------	1, 232	4, 523	----------	----------
Porto Rico	10	140	----------	----------	----------	----------
Rhode Island	4, 477	21, 850	10, 071	40, 802	4, 968	29, 176
St. Lawrence	69	572	29	228	----------	----------
San Antonio	713	6, 466	4, 560	34, 738	1, 686	13, 195
San Francisco	30, 019	158, 329	35, 139	150, 646	16, 468	72, 183
Vermont	512	4, 323	440	3, 085	124	883
Washington	7, 073	40, 262	12, 100	52, 013	14, 483	68, 750
	168, 859	1, 371, 568	147, 701	1, 132, 855	119, 724	1, 092, 235

TABLE 66.—*Coke imported into the United States, 1927–1929, by countries of origin*

Country	1927		1928		1929	
	Net tons	Value	Net tons	Value	Net tons	Value
Belgium	840	$4,435	5,878	$24,875	2,014	$10,152
Canada	99,267	985,868	51,152	648,832	56,762	733,833
Germany	41,079	213,100	10,951	51,441	5,846	33,855
Mexico	713	6,466	4,493	34,204	1,716	13,495
Netherlands	6,550	56,762	20,247	138,998	18,136	153,348
United Kingdom	20,400	104,797	54,980	234,505	35,250	147,552
West Indies ("Other British")	10	140				
	168,859	1,371,568	147,701	1,132,855	119,724	1,092,235

COKE IN CANADA

Most of the coke exported from the United States is shipped to Canada. The tonnage exported has tended to increase (Table 60), and the increase has gone largely for househeating. In 1929, the exports amounted to 1,238,035 tons, the largest reported since 1918, and of this over 1,170,000 tons went to Canada. At the same time Canada has increased her own production of domestic coke through the construction of new by-product ovens. Tables 67 and 68 have been abstracted from the reports of the Dominion Bureau of Statistics, which should be consulted for details. The tables include gas-house coke and breeze.

TABLE 67.—*Coal consumed, coke produced, etc., in Canada, 1929, by months, in net tons* [1]

Month	Bituminous coal consumed	Coke produced	Disposition of coke by operators		
			Used in coke plant	Used in own smelters	Sold
January	299,661	220,798	22,888	96,398	121,657
February	279,385	201,701	20,910	94,294	114,915
March	315,129	228,118	23,598	112,823	80,141
April	305,560	220,346	24,098	114,201	64,114
May	318,361	230,739	24,029	118,052	59,727
June	307,813	220,643	22,640	116,363	50,742
July	316,629	225,445	20,337	118,735	63,072
August	314,839	226,515	20,969	118,480	64,482
September	309,900	220,485	23,556	104,996	78,126
October	324,425	233,034	24,102	105,350	104,745
November	302,595	224,212	23,936	102,061	105,939
December	317,403	221,863	28,120	100,255	120,775
	[2] 3,711,700	2,673,899	279,183	1,302,008	1,028,435

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[1] Abstracted from Dominion Bureau of Statistics, 1929, Quarterly Report, vol. 8, No. 4.

[2] Of this total 2,751,855 tons was imported, chiefly from the United States.

TABLE 68.—*Production, imports, and consumption of coke in Canada, 1929, by months, in net tons* [1]

Month	Canadian production				Imports	Apparent consumption [2]
	Eastern Provinces	Ontario	Western Provinces	Total Canada		
January	69,096	135,469	16,233	220,798	135,141	354,486
February	62,675	124,745	14,281	201,701	90,903	289,938
March	70,610	140,731	16,777	228,118	122,041	347,106
April	70,304	134,243	15,799	220,346	42,035	261,466
May	73,324	139,745	17,670	230,739	77,635	306,665
June	69,511	133,783	17,349	220,643	103,537	321,842
July	69,332	139,024	17,089	225,445	122,737	346,374
August	71,158	138,433	16,924	226,515	90,054	313,178
September	70,756	133,164	16,565	220,485	85,661	304,596
October	76,273	139,204	17,557	233,034	129,978	361,152
November	71,882	135,016	17,314	224,212	125,299	346,865
December	66,609	137,512	17,742	221,863	101,832	321,876
	841,530	1,631,069	201,300	2,673,899	1,226,853	3,875,544

[1] Abstracted from Dominion Bureau of Statistics, 1929, Quarterly Report, vol. 8, No. 4.

[2] Allowing for exports which ordinarily are small.

WORLD PRODUCTION

TABLE 69.—*Coke produced in the principal countries of the world, 1925–1929, in metric tons* [1]

[Compiled by M. T. Latus, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
Australia:					
New South Wales	619,199	607,255	720,727	528,550	471,813
Queensland	5,470	6,290	4,263	4,123	4,144
Belgium	4,236,354	5,076,954	5,879,970	6,322,920	6,192,960
Bulgaria	1,193	1,582	1,448	898	(2)
Canada	959,438	1,329,314	1,366,623	1,675,421	1,986,532
China (exports)	[3] 19,217	14,551	[3] 12,989	14,211	13,467
Chosen	107,574	119,338	130,356	(4)	(4)
Czechoslovakia	2,015,968	1,961,762	2,428,584	2,821,423	3,170,629
France	6,016,000	6,908,000	7,118,000	7,957,000	9,085,000
Germany	28,397,379	27,297,398	33,242,495	34,774,959	39,421,033
Saar [5]	1,947,000	2,109,000	2,232,000	2,373,000	2,423,000
Great Britain [6]	11,185,375	4,790,420	12,027,121	12,035,326	13,637,421
Hungary	------------	------------	457	1,072	2,092
India, British [7]	478,753	554,045	661,506	757,501	(4)
Indo-China	1,153	2,565	(4)	2,500	637
Italy	512,264	591,528	578,445	636,399	791,607
Japan:					
Japan proper—					
Manufactured coke	849,202	1,035,409	1,086,023	1,237,754	(4)
Natural coke	89,877	130,381	143,447	165,883	(4)
Taiwan	13,409	[8] 15,602	(4)	(4)	(4)
Netherlands	1,143,806	1,198,609	1,478,822	1,573,392	2,402,566
Peru	18,010	25,960	13,812	19,331	35,899
Poland	963,964	1,113,380	1,402,008	1,667,906	1,858,052
Rhodesia, Southern	138,339	153,069	146,966	139,719	100,001
Russia [9]	1,350,300	2,755,841	3,327,904	5,103,741	(4)
Spain	861,130	693,739	714,243	680,555	768,040
Sweden	77,369	112,542	115,756	104,805	103,778
Union of South Africa	67,829	80,312	98,249	94,089	99,297
United States	46,508,345	51,587,278	46,349,770	47,904,391	54,325,427
	108,584,000	110,272,000	121,299,000	128,742,000	144,248,000

[1] Gas-house coke is not included.

[2] Data not available.

[3] Production estimated as follows: 1925, 695,535 tons; 1927, 500,000 tons (General Statement on the Mining Industry. China, Geol. Surv. Special Repts. Nos. 2 and 3, Peiping). Similar figures not available for other years.

[4] Estimate included in total.

[5] Revised figures. Includes foundry coke. (Germany, Reichskohlenrat—Statistische Uebersicht über die Kohlenwirtschaft.)

[6] In Great Britain the production of gas-house coke (including breeze), not included above, is especially important and was as follows: 1925, 12,022,759 tons; 1926, 11,784,401 tons; 1927, 12,562,447 tons; 1928, 12,411,903 tons; 1929, 12,610,467 tons.

[7] Figures represent only coke made at collieries.

[8] Includes a small quantity of gas-house coke.

[9] Year ended Sept. 30.

COKE-OVEN BY-PRODUCTS

RELATION TO OTHER SOURCES OF SUPPLY

By-products usually obtained at coke plants.—Much confusion exists in the popular mind as to the nature of the by-products recovered in coke manufacture. The modern coke plant is primarily a producer of specialized forms of fuel. In addition to the main product, coke, it makes another major fuel, gas. Gas is now the most valuable by-product, and at some coke plants its importance is scarcely second to that of the coke itself. The by-product plant recovers a number of crude materials incidental to coke and gas, which it ordinarily turns over to other industries for conversion into finished products. These crudes include tar, light oil (and its derivatives, benzol, toluol, and solvent naphtha), ammonia, naphthalene, and creosote oil, now recovered at a few plants. Occasionally small amounts of crude phenol, pitch, sulphur, sodium prussiate, smoke compound, extil covering, and tar paint complete the list of by-products.

In this list the dyestuffs and the medicines for which coal-tar derivatives are famous are conspicuous by their absence. The by-product oven is the principal source of the tar and other primary raw materials from which coal-tar dyes and many other organic chemicals are made, but with a few exceptions to which reference will be made later, these crude materials are turned over to other manufacturers for processing. The typical by-product coke plant strips the light oil from its gas and refines this to make motor benzol or perhaps a little refined benzol, toluol, and solvent naphtha. Its motor benzol usually goes to petroleum refiners for blending with gasoline. Its refined benzol, toluol, and solvents go chiefly to the chemical manufacturing industries. The typical plant also recovers ammonia—usually as sulphate destined for use as fertilizer, less often as ammoniacal liquor—and sells it through certain large distributors. When the naphthalene market is active it is prepared to supply crude naphthalene in indefinitely expansible amounts.

As for coal tar, the typical plant burns it as fuel, sells it to others for the same purpose, or sells it to a tar distiller, partly because the quantity of tar produced has so increased that it is now much greater than can be absorbed by the ultimate market for coal-tar derivatives and partly because the distillation of tar and the manufacture of dyes and chemicals require highly specialized technology and equipment.

Until recently the only important source of creosote oil was the tar refinery, but since 1928 a few by-product coke plants have begun to strip the creosote oil from their tar by a process of fractional condensation that relieves them of the necessity of handling the entire run of tar derivatives. The production of creosote oil from the new source promises to become an important element in the national supply of this indispensable product.

Relations to tar distillers.—In the United States, therefore, the function of breaking crude tar into its derivatives has developed as a distinct industry, typically carried on by corporations separate from the makers of coke. Some of the tar-refining companies are affiliated financially with the coke producers and the distillation plants are often located adjacent to the coke ovens, but even these companies are under distinct management. Bureau of Mines reports on the coke industry have therefore not included the operations of tar distillers. The United States Tariff Commission, on the other hand, follows tar distillation closely in its annual census of dyes and other synthetic organic chemicals. In 1929, according to the Tariff Commission, the firms engaged primarily in tar distillation produced the following crude materials not covered by the reports of the Bureau of Mines. (The figures are exclusive of products not classified as coal-tar crudes.)

Crude material	Quantity	Value
Anthracene, crude (less than 30 per cent)……pounds..	(1)	(1)
Anthracene oil……gallons..	(1)	(1)
Benzene (benzol)……do….	546, 268	$137, 364
Carbolic oil or middle oil……do….	214, 574	27, 060
Cresol or cresylic acid, crude……do….	(1)	(1)
Dead or creosote oil:		
Distillate as such……do….	101, 409, 233	12, 789, 189
Distillate in coal-tar solution……do….	42, 337, 599	4, 231, 406
Light oil……do….	(1)	(1)
Motor fuel……do….	(1)	(1)
Naphthalene, crude……pounds..	19, 501, 679	366, 491
Other distillates……gallons..	10, 007, 225	1, 322, 889
Pitch of tar……tons..	558, 378	8, 198, 124
Pseudocumene……gallons..	(1)	(1)
Pyridine……do….	(1)	(1)
Refined tars……barrels..	2, 440, 748	11, 537, 899
Solvent naphtha……gallons..	1, 259, 904	157, 912
Toluene (toluol)……do….	(1)	(1)
Xylene (xylol)……do….	(1)	(1)
Total crudes produced by tar distillates……	…………	40, 310, 326

[1] Figures included in total but not published separately to avoid disclosing individual operations.

It will be seen that the tar companies produce a number of substances that are also recovered by the coke companies. The principal products of tar distillation, in order of value, are creosote oil, pitch, and refined tar, which together comprise 90 per cent of the total value. Of these, the first is now being produced by coke operators, although on a much smaller scale. Among the lesser products of tar distillation are motor fuel, benzol, toluol, and solvent naphtha, all of which are obtained in much larger quantities by the by-product operator from the light oil stripped from his gas. To obtain complete figures on the production of coal-tar crudes it is therefore necessary to combine the quantities reported by the Bureau of Mines with those reported by the Tariff Commission. This is done in Table 99 (p. 663). The two offices collaborate in the preparation of these figures, and the totals are believed to represent the entire production from all sources and to eliminate duplications.

Additional supplies from gas works.—Further contributions to the national supply of coal-tar crudes come from carbonization of coal at city gas works. The few instances in which the gas company operates a complete tar refinery are covered by the Tariff Commission. In all other instances arrangements have been made to obtain information on gas works either through the Bureau of Mines or the Census Bureau, and the résumé of production of coal-tar crudes from all sources in Table 99 includes an allowance for this source as well.

SUMMARY OF BY-PRODUCTS IN 1929

The gross value of the by-products sold in 1929 was $163,675,571. (See Table 70.) This, however, does not include breeze or the value of tar used by the producer but not sold. If these two items are added, the gross value of all by-products amounts to $192,000,000 (See Table 7.) Twenty years ago it was only $8,000,000.

TABLE 70.—*By-products obtained from coke-oven operations in the United States, 1928 and 1929* [1]

[Exclusive of screenings and breeze]

Product	Production	Sales		
		Quantity	Value	
			Total	Average
1928				
Tar......gallons	631,844,767	332,150,270	$17,544,797	$0.053
Ammonia:				
Sulphate......pounds	1,387,895,214	1,318,369,804	24,826,744	.019
Ammonia liquor (NH_3 content)......do	52,469,456	52,584,975	2,513,312	.048
	----------	----------	27,340,056	----------
Sulphate equivalent of all forms......do	1,597,773,038	1,528,709,704	----------	----------
Gas:				
Used under boilers, etc......M cubic feet	[2] 775,512,939	18,620,112	1,132,547	.061
Used in steel or affiliated plants......do		286,132,946	31,509,424	.110
Distributed through city mains......do		125,131,465	39,935,641	.319
Sold for industrial use......do		24,588,049	3,921,245	.159
	----------	454,472,572	76,498,857	.168
Light oil and derivatives:				
Crude light oil......gallons	[3] 188,597,956	10,334,813	1,158,846	.121
Benzol, crude and refined......do	21,451,748	21,452,973	4,215,752	.197
Motor benzol......do	103,051,900	102,935,995	16,832,646	.164
Toluol, crude and refined......do	16,097,856	16,181,650	5,513,624	.341
Solvent naphtha and xylol......do	5,587,370	4,471,141	1,047,095	.234
Other light-oil products......do	3,114,531	1,388,106	111,844	.081
	[4] 149,303,405	156,764,678	28,879,807	.184
Naphthalene, crude and refined......pounds	12,182,143	10,937,429	135,693	.012
Creosote oil, including distillate as such and in coal-tar solution......gallons	12,386,000	7,377,816	823,990	----------
Phenol......do	57,794	66,607		
Pitch of tar......net tons	54,131	1,725		
Other products [5]......	----------	----------	86,328	----------
Value of all by-products sold......	----------	----------	151,309,528	----------
1929				
Tar......gallons	680,864,366	333,557,501	16,982,406	.051
Ammonia:				
Sulphate......pounds	1,488,314,447	1,433,465,592	25,861,479	.018
Ammonia liquor (NH_3 content)......do	56,028,347	55,470,678	2,820,802	.051
	----------	----------	28,682,281	----------
Sulphate equivalent of all forms......do	1,712,427,835	1,655,348,304	----------	----------
Gas:				
Used under boilers, etc......M cubic feet	[2] 843,148,089	18,506,502	1,282,327	.069
Used in steel or affiliated plants......do		302,165,465	31,901,504	.106
Distributed through city mains......do		160,560,921	46,994,632	.293
Sold for industrial use......do		26,357,691	4,125,807	.157
	----------	507,590,579	84,304,270	.166
Light oil and derivatives:				
Crude light oil......gallons	[3] 200,594,027	11,090,709	1,374,527	.124
Benzol, crude and refined......do	24,944,531	24,558,745	5,169,743	.211
Motor benzol......do	105,923,762	100,807,852	16,063,285	.159
Toluol, crude and refined......do	18,343,295	17,064,206	6,580,176	.386
Solvent naphtha and xylol......do	7,131,111	6,581,047	1,591,333	.242
Other light oil products......do	6,675,386	1,877,176	124,948	.067
	[4] 163,018,085	161,979,735	30,904,012	.191
Naphthalene, crude and refined......pounds	19,761,382	19,659,367	320,272	.016
Creosote oil, including distillate as such and in coal-tar solution......gallons	26,730,126	23,938,431	2,296,862	.096
Phenol (crude)......do	84,683	78,869	28,347	.359
Pitch of tar......net tons	88,158	5,599	27,273	4.871
Other products [5]......	----------	----------	129,848	----------
Value of all by-products sold......	----------	----------	163,675,571	----------

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[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name, excepting, however, phenol and other tar acids produced at Clairton, Pa., which are covered by report of the United States Tariff Commission.

[2] Includes gas wasted and gas used for heating retorts.

[3] Refined on the premises to make the derived products shown: 1928, 182,998,384 gallons of crude oil; 1929, 194,882,679 gallons.

[4] Total gallons of derived products.

[5] Sodium prussiate, carbolate, sulphur, smoke compound, extil covering, and tar paint.

TREND OF YIELDS AND PRICES

The long-time trends of by-product yields and unit prices are given in Tables 71 to 75 and Figures 22 and 30 to 32. In relation to the value of the coke the value of the by-products continues to increase (fig. 22). In 1913 the by-products contributed 27 per cent of the total gross value of all products, reckoned per ton of coke produced. In 1929 their share had increased to 43 per cent. The change is brought about in part by the recovery of additional by-products and in part by changes in prices received. Yields per ton have increased (see fig. 30 and Table 71), partly through selection of better coals and partly through improvements in oven design and by-product recovery equipment. The notable advance in the yield of surplus gas is due both to improvements in oven design and to the growing use of producer gas and blast-furnace gas for underfiring. Changes in unit prices are shown in Figure 31 and Table 73. In comparison with the war period, prices of tar and gas have increased, while prices of ammonia and the benzol products have declined. The result of these changes has been a notable shift in the relative gross receipts from the several products. (See fig. 32 and Table 74.) In 1913 ammonia furnished the largest gross income per ton of coke produced; during the war its position was taken by members of the benzol group, which were in demand for the manufacture of high explosives; to-day both ammonia and the benzols are subordinate to gas and even to tar. In fact, gas has increased so far in yield and price as to contribute 44 per cent of the gross value of all the by-products.

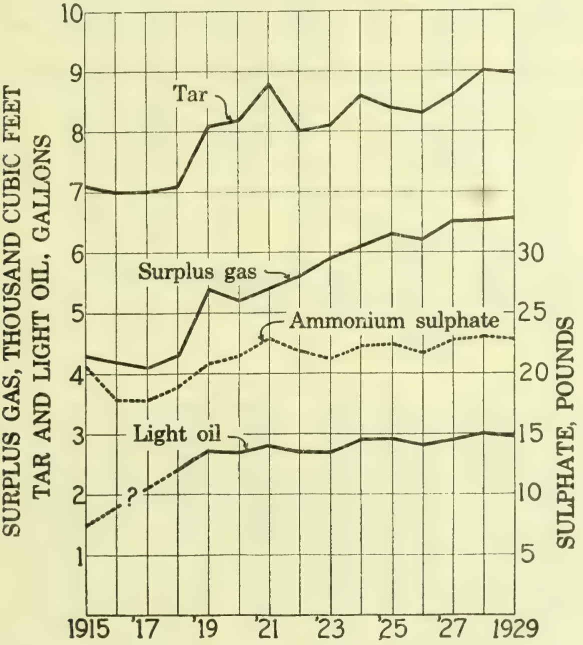

FIGURE 30.—Average yield of the principal by-products per net ton of coal carbonized in by-product coke ovens, 1915–1929. Figures for light oil represent the average at plants recovering light oil

TABLE 71.—*Average yield of coke and by-products per net ton of coal charged in by-product ovens in the United States, 1915, 1917, and 1923–1929*

Product	1915	1917	1923	1924	1925	1926	1927	1928	1929
Coke……pounds..	1,440	1,424	1,386	1,386	1,398	1,394	1,388	1,378	1,392
Tar……gallons..	7.1	7.0	8.1	8.6	8.4	8.3	8.65	9.00	8.87
Ammonium sulphate (or equivalent)……pounds..	20.1	17.8	21.2	22.2	22.4	21.7	22.69	22.77	22.31
Light oil……gallons..	1.5	([1])	[2] 2.7	[2] 2.9	[2] 2.9	[2] 2.8	[2] 2.92	[2] 2.97	[2] 2.93
Gas:									
Total……M cubic feet..	11.0	10.7	11.1	11.0	11.2	11.1	11.08	11.05	10.98
Surplus sold or used……do....	4.3	4.1	5.9	6.1	6.3	6.2	6.46	6.48	6.61
Burned in coking process……do....	6.3	6.0	5.0	4.7	4.7	4.7	4.44	4.31	4.13
Wasted……do....	.4	.6	.2	.2	.2	.2	.18	.26	.24

[1] Records not comparable.

[2] Average for plants now recovering light oil.

TABLE 72.—*Coal equivalent of the by-products of by-product coking, 1914–1929*

Year	Quantity of by-products				Rough equivalent in heating value (billion B. t. u.)					Coal equivalent	
	1	2	3	4	5	6	7	8	9	10	11
	Coke breeze (thousand net tons)	Surplus gas (billion cubic feet)	Tar produced (thousand gallons)	Light oil produced (thousand gallons)	Coke breeze (1×20)	Surplus gas (2×550)	Tar (3× 0.150)	Light oil (4× 0.130)	Total (5+6+7+8)	Net tons (9÷0.0262)	Per cent which this forms of coal made into coke
1914...	667	61	109,901	8,464	13,340	33,550	16,485	1,100	64,475	2,461,000	4.8
1915...	841	84	138,415	16,601	16,820	46,200	20,762	2,158	85,940	3,280,000	5.3
1916...	1,031	110	185,506	43,710	20,620	60,500	27,826	5,682	114,628	4,375,000	5.4
1917...	1,496	131	221,999	54,387	29,920	72,050	33,300	7,070	142,340	5,432,000	6.5
1918...	1,999	158	263,299	87,562	39,980	86,900	39,495	11,383	177,758	6,785,000	8.0
1919...	1,849	193	288,902	92,473	36,980	106,150	43,335	12,021	198,486	7,575,000	11.5
1920...	2,461	230	360,664	109,710	49,220	126.500	54,100	14,262	244,082	9,316,000	12.2
1921...	1,831	154	253,052	76,917	36,620	84,700	37,958	9,999	169,277	6,461,000	17.4
1922...	2,395	231	327,780	101,438	47,900	127,050	49,167	13,187	237,304	9,058,000	16.7
1923...	3,333	318	440,907	135,647	66,660	174,900	66,136	17,634	325,330	12,417,000	14.7
1924...	2,951	301	422,074	128,957	59,020	165,550	63,311	16,764	304,645	11,628,000	17.9
1925...	3,546	362	480,849	146,443	70,920	199,100	72,127	19,038	361,185	13,786,000	18.5
1926...	4,183	398	529,486	164,060	83,660	218,900	79,423	21,328	403,311	15,394,000	18.6
1927...	4,100	408	546,859	164,488	82,000	224,400	82,029	21,383	409,812	15,642,000	21.0
1928...	4,378	454	631,845	188,598	87,560	249,700	94,777	24,518	456,555	17,426,000	22.6
1929...	4,853	508	680,864	200,594	97,060	279,400	102,130	26,077	504,667	19,262,000	22.2

TABLE 73.—*Average receipts per unit of coke-oven by-products sold, 1913–1929*

[The figures in this table for 1913 to 1917 represent "average value of by-products produced and sold." For 1918 to 1929 they represent "average receipts from sales." The two sets of figures are probably comparable for practical purposes]

	Tar	Sulphate	Surplus gas	Benzol, refined	Motor benzol	Toluol, refined	Solvent naphtha	Naphthalene	
								Crude	Refined
Unit	Gallon	Pound	M cubic feet	Gallon	Gallon	Gallon	Gallon	Pound	Pound
	Cents	*Cents*	*Cents*	*Cents*	*Cents*		*Cents*	*Cents*	
1913	2.5	3.1	8.8	[1] 27.0	([2])	[1] $0.29	[1] 25.0	([2])	
1914	2.6	2.8	9.8	[1] 26.0	([2])	[1] .33	[1] 25.0	([2])	
1915	2.6	2.8	10.2	56.8	([3])	2.45	24.0	[4] 10.0	
1916	2.6	3.1	9.8	62.4	([3])	2.85	28.4	[4] 3.4	
1917	2.7	3.4	8.7	45.0	([3])	1.37	16.6	[4] 3.3	
1918	3.2	4.5	8.7	27.5	([3])	1.43	14.1	2.8	6.6
1919	3.2	3.8	8.6	20.6	([5])	.263	15.2	2.0	4.1
1920	3.7	4.3	14.0	26.0	22.7	.300	18.1	2.7	6.1
1921	4.2	2.5	16.8	23.9	17.9	.283	17.7	2.5	5.6
1922	4.0	2.5	16.7	28.5	19.1	.292	18.8	1.6	5.0
1923	4.4	2.9	16.2	24.8	16.3	.291	17.9	1.7	5.5
1924	4.6	2.4	16.5	20.9	15.2	.241	18.7	1.5	3.6
1925	4.9	2.3	17.0	22.4	16.6	.261	20.2	1.0	2.5
1926	5.1	2.1	16.3	22.8	18.8	.338	29.2	1.3	([6])
1927	5.3	2.0	17.2	[4] 20.6	16.9	.340	25.3	1.1	---------
1928	5.3	1.9	16.8	[4] 19.7	16.4	[4] .341	23.4	[4] 1.2	
1929	5.1	1.8	16.6	[4] 21.1	15.9	[4] .386	24.2	[4] 1.6	

[1] Trade quotations, New York market; used to avoid disclosing individual operators' reports.
[2] No data.
[3] Not reported during the war.
[4] Crude and refined not separated.
[5] Data uncertain.
[6] Sales too small to be representative.

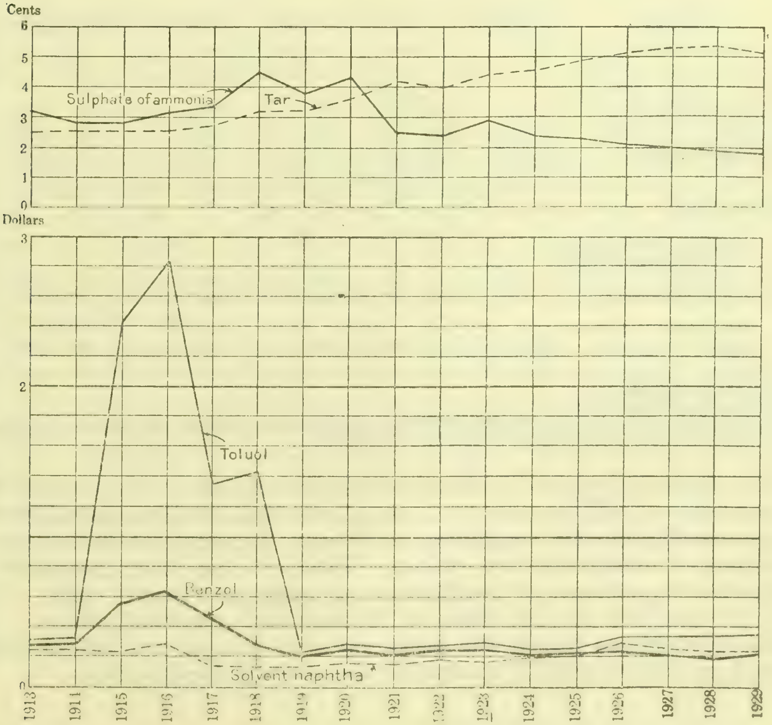

FIGURE 31.—Average receipts per unit for the principal refined light oils and other products at by-products coke plants, 1913–1929

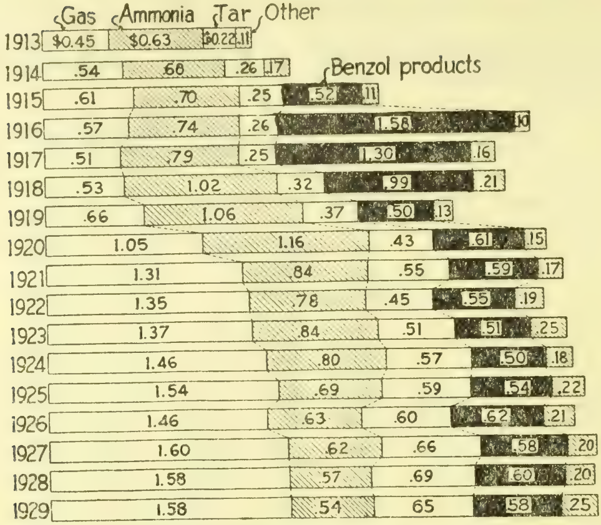

FIGURE 32.—Gross value of the several by-products per ton of by-product coke produced, 1913–1929

TABLE 74.—*Value of by-products and of coke, including breeze, per ton of coke produced in the United States, 1915, 1917, 1918, and 1923–1929*

Product	1915	1917	1918	1923	1924	1925	1926	1927	1928	1929
Ammonia and its compounds	$0.70	$0.79	$1.02	$0.84	$0.80	$0.69	$0.63	$0.62	$0.57	$0.54
Light oil and its derivatives (including naphthalene)	.52	1.30	.99	.51	.50	.54	.62	.58	.60	.58
Surplus gas sold or used	.61	.51	.53	1.37	1.46	1.54	1.46	1.60	1.58	1.58
Tar sold	.25	.25	.24	.25	.28	.30	.32	.37	.36	.32
Miscellaneous products	.03	.06	.09	.01	-------	-------	-------	-------	.02	.05
	2.11	2.91	2.87	2.98	3.04	3.07	3.03	3.17	3.13	3.07
Tar used, not sold	(1)	(1)	.08	.26	.29	.29	.28	.29	.33	.33
Breeze produced	(2)	.10	.12	.24	.18	.22	.21	.20	.20	.20
Total value of by-products including those not sold	2.19	3.01	3.07	3.48	3.51	3.58	3.52	3.66	3.66	3.60
Value of coke produced	3.45	6.18	7.42	[3] 6.85	[3] 5.76	[3] 5.28	[3] 5.65	[3] 5.29	[3] 4.90	[3] 4.80
Total value of coke and by-products	5.64	9.19	10.49	10.33	9.27	8.86	9.17	8.95	8.56	8.40

[1] Included in tar sold.
[2] Estimate included in total.
[3] The average receipts per ton of coke sold during these years were $8.53 in 1923, $6.90 in 1924, $6.61 in 1925, $6.95 in 1926, $6.57 in 1927, $5.95 in 1928, and $5.94 in 1929.

The figures given in Table 74 and Figure 32 are a composite of the experiences of all by-product coke plants and are dominated by the large establishments associated with iron furnaces, at which gas is credited at relatively low prices. Table 75 has been prepared to show the experience of nonfurnace or merchant plants only. (See pp. 586 and 595 for definition of furnace and merchant plants.) At these nonfurnace plants the gross value of gas per ton of coke produced in 1929 was $3.40 or double the average for all plants.

TABLE 75.—*Gross value f. o. b. plant of all products reported by nonfurnace by-product coke plants, 1929*

[Values added by distribution not included. Plants include by-product plants operated by city gas companies and alkali manufacturers as well as merchant coke plants]

Product	Total value	Per cent of total value	Value per ton of coke produced	Value per M cubic feet of surplus gas produced
Coke:				
Used by producer	$9, 575, 767	6. 8	----------	$0. 070
Sold for furnace use	9, 514, 260	6. 7	----------	. 069
Sold for foundry use	13, 949, 330	9. 8	----------	. 102
Sold for other industrial use	8, 380, 046	5. 9	----------	. 061
Sold for domestic use	37, 878, 994	26. 7	----------	. 276
Total coke	79, 298, 397	55. 9	$6. 51	. 578
Breeze:				
Used by producer for steam raising or other use	2, 043, 396	1. 4	----------	. 015
Sold	554, 207	. 4	----------	. 004
Total breeze	2, 597, 603	1. 8	. 22	. 019
Tar	7, 230, 144	5. 1	. 59	. 053
Ammonia	6, 325, 510	4. 4	. 52	. 046
Surplus gas:				
Used under boilers	546, 457	. 4	----------	. 004
Used in affiliated plants	154, 715	. 1	----------	. 001
Distributed through city mains	38, 344, 102	27. 0	----------	. 280
Sold for industrial use	2, 405, 809	1. 7	----------	. 017
Total gas	41, 451, 083	29. 2	3. 40	. 302
Light-oil products	5, 057, 093	3. 6	. 41	. 037
Naphthalene	2, 090	----------	----------	----------
Total gross value	141, 961, 920	100. 0	11. 65	1. 035
Cost of coal carbonized	72, 350, 677	----------	5. 94	. 527

TAR

The total quantity of tar produced at coke ovens in 1929 was 680,864,366 gallons. Of this amount 43,019,024 gallons was consumed in refining operations conducted either on the premises or at directly affiliated plants. A total of 299,195,878 gallons was used by the producers; almost all of this—293,948,414 gallons to be exact—was burned in open-hearth furnaces or in other affiliated works, while 4,101,803 gallons was consumed as fuel under boilers and 1,145,661 was used otherwise.

The sales in 1929 amounted to 333,557,501 gallons. Asked to specify the uses for which the sales went the operators reported that 45,309,241 gallons was disposed of as fuel, leaving 288,248,260 gallons sold for refining into tar products. This is the first time that figures on the disposition of the quantity sold have been obtained, and they indicate that by no means all of the sales reported in earlier years have gone to tar distillers.

TABLE 76.—*Coke-oven tar produced and sold in the United States in 1929, by States*[1]

State	Total produced (gallons)	Sold				
		For use as fuel (gallons)	For refining into tar products (gallons)	Total sold (gallons)	Value	
					Total	Average
Alabama	61,018,525	8,475,140	25,865,925	34,341,065	$1,868,466	$0.054
Colorado	8,044,614	----------	527	527	(2)	(2)
Illinois	45,322,665	4,713,334	31,911,844	36,625,178	2,024,715	.055
Indiana	52,145,645	----------	18,145,942	18,145,942	719,855	.040
Maryland	14,246,568	----------	14,430,600	14,430,600	(2)	(2)
Massachusetts	9,229,414	1,331,383	7,561,675	8,893,058	503,140	.057
Michigan	30,804,098	----------	16,121,564	16,121,564	739,517	.046
Minnesota	8,454,270	(3)	[3] 6,254,402	6,254,402	381,143	.061
New Jersey	10,154,949	----------	10,048,305	10,048,305	(2)	(2)
New York	55,891,433	(3)	[3] 41,405,394	41,405,394	2,155,821	.052
Ohio	108,062,552	7,322,890	46,929,116	54,252,006	2,753,166	.051
Pennsylvania	231,057,712	23,466,494	27,676,961	51,143,455	2,279,842	.045
Tennessee	1,101,717	----------	1,049,564	1,049,564	46,822	.045
Utah	5,631,500	----------	5,591,279	5,591,279	(2)	(2)
Washington	546,743	----------	538,370	538,370	32,087	.060
West Virginia	20,780,107	----------	17,528,380	17,528,380	918,683	.052
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	18,371,854	----------	17.188,412	17,188,412	902,546	.053
Undistributed	----------	----------	----------	----------	1,656,603	.055
Total	680,864,366	[3] 45,309,241	[3] 288,248,260	333,557,501	16,982,406	.051
From merchant ovens	141,726,385	1,331,383	133,584,038	134,915,421	7,230,144	.054
From furnace ovens	539,137,981	[3] 43,977,858	[3] 154,664,222	198,642,080	9,752,262	.049

State	Used (gallons)			On hand Dec. 31 (gallons)
	As fuel under boilers	In open hearth or affiliated plants	Otherwise	
Alabama	61,229	24,808,426	345,066	4,577,171
Colorado	----------	8,051,650	2,715	153,620
Illinois	----------	6,315,559	25,520	4,249,372
Indiana	----------	29,389,458	----------	4,298,433
Maryland	----------	233,380	----------	960,555
Massachusetts	----------	----------	----------	2,414,481
Michigan	509,564	14,669,325	----------	2,504,452
Minnesota	----------	(2)	(2)	514,523
New Jersey	----------	----------	----------	550,373
New York	----------	(2)	764,798	4,113,068
Ohio	2,403,335	52,700,208	4,000	8,241,808
Pennsylvania	1,127,675	141,725,050	191	13,638,224
Tennessee	----------	----------	----------	117,278
Utah	----------	----------	----------	165,399
Washington	----------	----------	758	27,794
West Virginia	----------	3,143,940	----------	838,565
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	----------	----------	(2)	1,989,874
Undistributed	----------	12,911,418	2,613	----------
Total	4,101,803	293,948,414	1,145,661	49,354,990
From merchant ovens	----------	----------	766,322	14,797,473
From furnace ovens	4,101,803	293,948,414	379,339	34,557,517

[1] This table excludes the quantity of tar "refined at plant," which in 1929 amounted to 43,019,024 gallons.
[2] Included under "Undistributed."
[3] A small quantity of tar used as fuel is included with that refined into tar products.

The trend of the relative quantities used and sold is shown by Tables 77 and 78. From 24 per cent in 1918 the proportion used by the producer has increased to 51 per cent in 1929. On the other hand, the proportion sold has fallen from 76 per cent in 1918 to 49 per cent in 1929, and as already pointed out a considerable part of the sales went for purposes other than distillation into refined products. These changes are a striking evidence that the volume of tar now produced much exceeds the demand for distillation. Much more than half of the present output is disposed of as fuel, its price being determined essentially by the competitive price of fuel oil.

TABLE 77.—*Disposal of coke-oven tar produced in the United States, 1927–1929, in gallons*

	Furnace plants	Other plants	Total
1927			
Sold	197, 429, 480	108, 468, 696	305, 898, 176
Used:			
As fuel under boilers	6, 813, 532	24, 500	6, 838, 032
In open-hearth or other metallurgical plants	225, 345, 259	-----	225, 345, 259
1928			
Sold	222, 766, 734	109, 383, 536	332, 150, 270
Used:			
As fuel under boilers	4, 383, 254	949, 523	5, 332, 777
In open-hearth or other metallurgical plants	257, 687, 325	-----	257, 687, 325
Refined at plant	(1)	(1)	23, 557, 527
1929			
Sold:			
For use as fuel	47, 157, 284	1, 331, 383	48, 488, 667
For refining into tar products	151, 484, 796	133, 584, 038	285, 068, 834
Used:			
As fuel under boilers	4, 101, 803	-----	4, 101, 803
In open-hearth or other metallurgical plants	293, 948, 414	-----	293, 948, 414
Refined at plant	39, 004, 433	4, 014, 591	43, 019, 024

[1] Not at liberty to publish.

TABLE 78.—*Per cent of coke-oven tar sold and per cent used by the producer, 1918–1929* [1]

Year	Sold	Used by producer	Year	Sold	Used by producer
1918	76. 0	24. 0	1924	49. 7	50. 3
1919	75. 4	24. 6	1925	49. 9	50. 1
1920	48. 3	51. 7	1926	52. 4	47. 6
1921	53. 5	46. 5	1927	55. 9	44. 1
1922	49. 5	50. 5	1928	52. 6	47. 4
1923	48. 0	52. 0	1929	49. 0	51. 0

[1] Not all the tar sold is taken by tar distillers. Of the 49 per cent sold in 1929 about 42 per cent went for refining into tar products and 7 per cent for use as fuel. Although no division of sales is available prior to 1929, it is clear that for some years a considerable proportion of the sales has gone for use as fuel.

The yield of coke-oven tar per ton of coal charged varies widely, depending in part upon the character of the coal charged. Table 79 shows the yield in each State for the last seven years.

TABLE 79.—*Average yield of coke-oven tar, by States, 1923–1929*

[Figures represent gallons per ton of coal charged]

State	1923	1924	1925	1926	1927	1928	1929	Average for 7 years shown
Alabama	8. 3	8. 2	8. 4	8. 7	9. 0	9. 3	9. 1	8. 7
Colorado	10. 1	9. 5	10. 4	10. 7	10. 5	9. 8	9. 7	10. 1
Illinois	7. 3	7. 9	7. 9	7. 7	8. 3	8. 2	7. 6	7. 8
Indiana	6. 2	6. 1	5. 9	5. 8	6. 1	6. 2	6. 0	6. 0
Maryland	7. 0	6. 8	6. 9	6. 5	6. 8	7. 6	7. 5	7. 0
Massachusetts	7. 9	8. 3	7. 5	8. 9	9. 2	9. 0	8. 2	8. 4
Michigan	7. 1	7. 6	7. 4	7. 3	7. 5	8. 2	8. 2	7. 6
Minnesota	7. 7	8. 4	8. 0	7. 3	7. 0	7. 2	8. 0	7. 7
New Jersey	7. 9	8. 4	8. 1	8. 0	7. 8	8. 2	8. 1	8. 1
New York	8. 7	8. 7	8. 6	8. 8	9. 0	9. 1	9. 0	8. 8
Ohio	8. 5	9. 0	9. 1	8. 6	8. 8	8. 9	8. 8	8. 8
Pennsylvania	9. 1	9. 9	9. 3	9. 4	9. 7	10. 5	10. 7	9. 8
Tennessee	2. 6	8. 9	8. 2	7. 5	7. 4	7. 4	6. 8	7. 0
Utah	-----	10. 4	11. 3	11. 4	12. 0	11. 7	11. 8	11. 4
Washington	7. 3	8. 2	8. 1	7. 9	7. 5	7. 9	8. 3	7. 9
West Virginia	10. 7	11. 3	10. 2	10. 1	10. 0	10. 5	10. 1	10. 4
Connecticut,[1] Kentucky, Missouri, Rhode Island, and Wisconsin	7. 5	8. 3	8. 0	7. 2	8. 2	7. 8	7. 5	7. 8
United States	8. 1	8. 6	8. 4	8. 3	8. 6	9. 0	8. 9	8. 6

[1] 1928 first year of production.

In addition to the tar obtained from coke ovens, about 50,000,000 gallons of coal tar is available from gas works. The supply from both sources is shown in Table 80. As already pointed out, the sales of coke-oven tar go in part for boiler fuel. The total quantity treated at distillation plants in 1929 is given by the Tariff Commission as 367,340,000 gallons.[7]

TABLE 80.—*Production and sales of coke-oven, coal-gas, water-gas, and oil-gas tar in the United States, 1918–1929*

	Coke-oven tar [a]	Coal-gas tar [b]	Total coal tar	Water and oil gas tar
Production (gallons):				
1918	263, 299, 470	52, 694, 826	315, 994, 296	100, 985, 156
1919	288, 901, 739	53, 146, 421	342, 048, 160	[c] 105, 318, 339
1920	360, 664, 124	51, 264, 956	411, 929, 080	116, 073, 907
1921	253, 051, 649	([d])	309, 051, 649	([e])
1922	327, 779, 734	48, 082, 228	375, 861, 962	104, 555, 028
1923	440, 907, 109	([d])	493, 407, 109	([e])
1924	422, 074, 326	([f])	475, 074, 326	([e])
1925	480, 848, 814	([d])	534, 848, 814	([e])
1926	529, 486, 374	([f])	583, 486, 374	([e])
1927	546, 859, 205	([d])	600, 859, 205	([e])
1928	631, 844, 767	([f])	688, 344, 767	([e])
1929	680, 864, 366	([f])	736, 864, 366	([e])
Sales (gallons):				
1918	200, 233, 002	47, 727, 839	247, 960, 841	55, 283, 484
1919	217, 707, 157	49, 307, 852	267, 015, 009	[c] 58, 557, 947
1920	174, 363, 696	46, 604, 133	220, 967, 829	59, 238, 730
1921	135, 293, 047	51, 976, 307	187, 269, 354	[c] 53, 432, 945
1922	162, 204, 417	41, 266, 074	203, 470, 491	47, 338, 489
1923	211, 739, 469	47, 840, 512	259, 579, 081	[c] 49, 990, 820
1924	209, 979, 999	([f])	258, 479, 999	([e])
1925	240, 160, 986	49, 175, 979	289, 336, 965	[c] 61, 471, 124
1926	277, 248, 522	([f])	326, 248, 522	([e])
1927	305, 898, 176	51, 266, 279	357, 164, 455	[c] 83, 479, 339
1928	332, 150, 270	([f])	383, 150, 270	([e])
1929	333, 557, 501	([f])	384, 057, 501	([e])
Value of sales:				
1918	$6, 364, 972	$1, 863, 580	$8, 228, 552	$1, 805, 865
1919	6, 918, 549	2, 156, 471	9, 075, 020	[c] 2, 012, 723
1920	6, 378, 040	2, 010, 186	8, 388, 226	2, 109, 388
1921	5, 645, 309	2, 811, 728	8, 457, 037	[c] 2, 192, 015
1922	6, 419, 743	1, 955, 950	8, 375, 693	1, 879, 490
1923	9, 250, 552	2, 461, 691	11, 712, 243	[c] 2, 001, 363
1924	9, 623, 520	([f])	12, 293, 520	([e])
1925	11, 903, 196	2, 750, 719	14, 653, 915	[c] 2, 594, 025
1926	14, 103, 760	([f])	16, 803, 760	([e])
1927	16, 095, 478	2, 923, 819	19, 019, 297	[c] 3, 768, 464
1928	17, 544, 797	([f])	20, 454, 797	([e])
1929	16, 982, 406	([f])	19, 862, 406	([e])

[a] Includes tar produced in by-product coke ovens operated by city gas companies.

[b] The figures here given for coal-gas tar include only the operations of coal-gas retorts. For 1918, 1920, and 1922 they are taken from special studies by the U. S. Geological Survey. For 1919, 1921, 1923, 1925, and 1927, revised census figures are used, obtained by subtracting from the totals for the manufactured-gas industry, as published by the Census Bureau, the tar produced at by-product coke ovens operated by city gas companies.

[c] As reported by the Bureau of the Census.

[d] Estimate included in total, based upon reported sales as given below.

[e] No data.

[f] Estimate included in total.

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[7] U. S. Tariff Commission, Census of Dyes and Other Synthetic Organic Chemicals: 1929, p. 20.

AMMONIA

TABLE 81.—*Ammonia produced at coke-oven plants, by States, in 1929, in pounds*

State	Sulphate	Liquor (NH_3 content)	Sulphate equivalent of all forms	
			Total	Per ton of coal coked
Alabama	(1)	(1)	168, 725, 486	25. 1
Colorado	17, 913, 100		17, 913, 100	21. 6
Illinois	(1)	(1)	130, 749, 095	21. 8
Indiana	129, 266, 384	5, 603, 009	151, 678, 420	17. 3
Maryland	39, 117, 324		39, 117, 324	20. 4
Massachusetts	(1)	(1)	23, 028, 620	20. 4
Michigan	39, 479, 760	10, 826, 904	82, 787, 376	22. 0
Minnesota	23, 819, 291		23, 819, 291	22. 4
New Jersey	28, 034, 397		28, 034, 397	22. 5
New York	(1)	(1)	141, 123, 184	22. 8
Ohio	[2] 734, 405, 514	[2] 12, 067, 352	285, 539, 845	23. 2
Pennsylvania			497, 135, 077	22. 0
Tennessee	3, 229, 597		3, 229, 597	20. 1
Utah	14, 227, 000		14, 227, 000	28. 8
Washington		517, 532	2, 070, 128	31. 4
West Virginia	48, 837, 462		48, 837, 462	23. 7
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	22, 568, 429	7, 961, 001	54, 412, 433	22. 2
Undistributed	387, 416, 189	19, 052, 549		
Total	1, 488, 314, 447	56, 028, 347	1, 712, 427, 835	22. 3
From merchant ovens	221, 277, 526	42, 967, 784	393, 148, 662	22. 9
From furnace ovens	1, 267, 036, 921	13, 060, 563	1, 319, 279, 173	22. 1

[1] Included under "Undistributed."

[2] Figures for Ohio and Pennsylvania combined to avoid disclosing individual operations.

TABLE 82.—*Yield of ammonium sulphate equivalent reported by coke-oven plants in 1921, 1928, and 1929*

	1921	1928	1929
Total ammonium sulphate or equivalent recovered..pounds	657, 001, 003	1, 597, 773, 038	1, 712, 427, 835
Yield of sulphate per ton of coal coked:			
At plant reporting minimum average yield........do	3. 6	6. 3	9. 8
At plant reporting maximum average yield........do	30. 3	32. 8	31. 4
At average plant [1]........do	21. 9	22. 9	23. 0
Average yield for all coal coked [2]........do	22. 8	22. 8	22. 3
Total number of plants reporting recovery of ammonia	67	85	87
Number of plants recovering—			
Less than 10 pounds per ton of coal	2	1	1
10–14.9 pounds	2	2	1
15–19.9 pounds	14	6	8
20–21.9 pounds	11	20	21
22–23.9 pounds	13	24	24
24–25.9 pounds	15	18	19
26–27.9 pounds	3	12	9
28–29.9 pounds	6	1	3
30 pounds or more	1	1	1

[1] Sum of averages for all plants divided by number of plants.

[2] Total yield in sulphate equivalent divided by number of tons of coal carbonized.

TABLE 83.—*Average monthly prices of sulphate of ammonia per 100 pounds, 1914–1929*

[Quotations, 1914–1916, abstracted from Oil, Paint, and Drug Reporter, at New York; 1917–1929, from Steel, f. o. b. producers' works. Figures for 1914–1922 compiled by C. G. Atwater, of the Barrett Co.]

Month	1914	1915	1916	1917	1918	1919	1920	1921
January	$2.90	$2.71¼	$3.96½	$4.12	$5.03	$4.68	$4.00	$3.37½
February	2.85	2.98¾	3.96¼	4.18	5.22½	4.50	4.00	3.12½
March	2.85	3.16	3.92½	[1]	5.40½	4.25	4.55	2.92½
April	2.85	3.10⅝	3.68¾	[1]	5.46	4.00	4.55	2.57½
May	2.70	3.20	3.57½	4.72½	5.59½	3.80	4.55	2.45
June	2.55	3.22½	3.53	4.80	5.10	3.60	4.55	2.45
July	2.52	3.41	3.43½	4.90	4.50	3.40	4.55	2.35
August	2.60	3.53	3.58¾	4.90	4.50	3.53	4.80	2.00
September	2.76⅞	3.37½	3.77½	4.92½	4.50	3.53	4.80	1.95
October	2.67½	3.37½	4.02½	4.95	4.50	3.57	4.25	2.20
November	2.67½	3.57	4.21¼	4.92½	4.50	3.78	3.75	2.20
December	2.67½	3.93¾	4.32½	4.90	4.86	3.93	3.38	2.20
Average	2.71	3.30	3.83	4.73	4.93	3.88	4.31	2.48

Month	1922	1923	1924	1925	1926	1927	1928	1929
January	$2.20	$3.10	$2.72½	$2.67½	$2.82½	$2.50	$2.325	$2.30
February	2.35	3.15⅝	2.72½	2.62½	2.72½	2.52½	2.325	2.30
March	2.60½	3.19½	2.72½	2.52½	2.68½	2.52½	2.35	2.30
April	2.65	3.22½	2.65	2.52½	2.62½	2.50	2.35	2.30
May	2.67	3.21½	2.62½	2.42½	2.62½	2.42	2.35	2.25
June	2.72	3.13¾	2.57½	2.37½	2.50	2.42	2.20	2.22½
July	2.82	3.10	2.50	2.67½	2.47½	2.25	2.20	2.22½
August	2.82	3.07½	2.35	2.75	2.47½	2.25	2.20	2.22½
September	2.90	3.02½	2.50	2.80	2.47½	2.30	2.20	2.20
October	3.05	3.01¼	2.60	2.95	2.47½	2.32½	2.30	2.15½
November	3.07	2.93¾	2.65	2.85	2.47½	2.32½	2.30	2.10
December	3.12	2.76¼	2.67½	2.80	2.47½	2.32½	2.30	2.05
Average	2.75	3.08	2.61	2.66	2.57	2.39	2.28	2.22

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[1] No market.

LIGHT OIL AND ITS DERIVATIVES

TABLE 84.—*Number of plants making light oil or derivatives, by States, 1928 and 1929*

State	1928				1929			
	Total making coke	Making crude light oil	Making any refined product	Making motor benzol	Total making coke	Making crude light oil	Making any refined product	Making motor benzol
Alabama	8	8	6	6	8	8	6	6
Colorado	1	1	1	1	1	1	1	1
Illinois	8	4	3	2	8	4	3	2
Indiana	7	4	4	4	7	4	4	4
Maryland	1	1	1	1	1	1	1	1
Massachusetts	3				3			
Michigan	7	3	2	2	7	3	3	2
Minnesota	3	1	1	1	3	2	1	1
New Jersey	2				2			
New York	9	7	6	6	9	7	6	6
Ohio	15	15	13	13	15	15	13	12
Pennsylvania	10	9	8	8	12	10	9	9
Tennessee	1	1	1	1	1	1	1	1
Utah	1	1	1	1	1	1	1	1
Washington	1				1			
West Virginia	3	3	3	3	3	3	3	3
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	3	3		5	3	2	1
	85	61	53	49	87	63	54	50

TABLE 85.—*Crude light oil produced at coke-oven plants in the United States in 1929, by States, in gallons* [1]

State	Average yield per ton of coal coked	Produced	Refined on the premises	Total derived products obtained from refining operations
Alabama	2.9	19,607,676	17,833,536	15,137,411
Colorado	3.3	2,725,150	2,728,578	2,120,240
Illinois	2.6	10,948,568	7,066,883	5,519,934
Indiana	2.7	21,938,225	21,951,389	18,264,414
Maryland	2.5	4,815,288	4,776,446	3,936,370
New York	2.7	13,565,875	21,188,958	17,940,371
Ohio	3.1	38,165,645	35,524,363	28,352,903
Pennsylvania	3.2	65,700,270	65,402,665	56,580,242
Tennessee	2.4	388,800	393,036	327,287
Utah	4.1	2,014,500	2,014,500	1,652,000
West Virginia	3.1	6,469,594	6,468,356	5,101,011
Kentucky, Michigan, Minnesota, Missouri, and Wisconsin	2.4	14,254,436	9,533,969	8,085,902
Total	2.9	200,594,027	194,882,679	163,018,085
From merchant ovens	2.5	25,377,881	22,558,026	18,896,286
From furnace ovens	3.0	175,216,146	172,324,653	144,121,799

[1] In addition to the quantity refined on the premises, a few plants reported the sale of crude light oil. The total quantity sold in 1929 was 11,090,709 gallons, valued at $1,374,527, or 12.4 cents per gallon.

TABLE 86.—*Production of motor fuel in the United States, 1918–1929, in gallons*

Year	Gasoline production of petroleum refineries	Natural gasoline (total production)	Benzol produced, all grades, including motor benzol		
			Coke ovens	Gas works, including oil and water gas	Tar refineries, etc.[1]
1918	3,570,000,000	283,000,000	44,805,000	[2] 5,633,000	3,015,000
1919	3,958,000,000	352,000,000	61,068,000	(3)	1,826,000
1920	4,883,000,000	385,000,000	72,994,000	[4] 502,000	876,000
1921	5,154,000,000	450,000,000	54,459,000	(5)	2,172,000
1922	6,202,000,000	506,000,000	70,112,000	(5)	[6] 775,000
1923	7,556,000,000	816,000,000	97,335,000	(5)	[6] 395,000
1924	8,960,000,000	934,000,000	91,904,000	(5)	[6] 630,000
1925	10,903,000,000	1,127,000,000	103,821,000	(5)	[6] 742,000
1926	12,589,000,000	1,363,000,000	112,489,000	(5)	[6] 377,000
1927	13,878,000,000	1,641,000,000	109,003,000	(5)	[6] 371,000
1928	15,832,000,000	1,814,000,000	124,504,000	(5)	[6] 474,000
1929	18,273,000,000	2,234,000,000	130,868,000	(5)	[6] 546,000

[1] As reported to the U. S. Tariff Commission.
[2] Of this only 2,177,000 gallons was sold, the balance being returned to the gas.
[3] Data not available in comparable form.
[4] Quantity sold, used because of apparent double counting between production figures of crude and refined benzol.
[5] Can not be shown without disclosing individual returns.
[6] Does not include a small amount of motor benzol which can not be shown without disclosing individual returns.

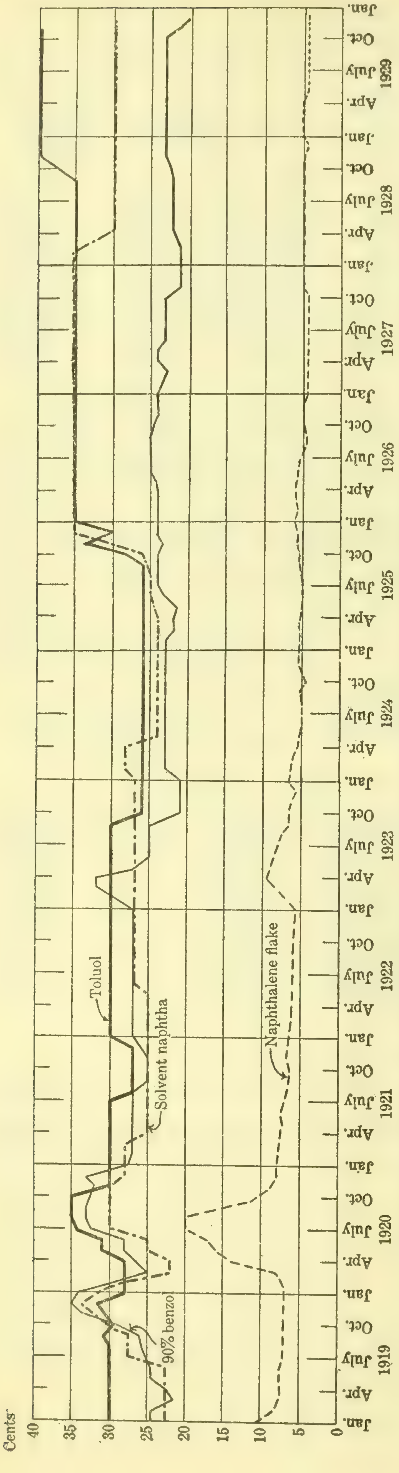

FIGURE 33.—Spot prices of 90 per cent benzol, toluol, solvent naphtha, and flake naphthalene in New York, by months, 1919-1929

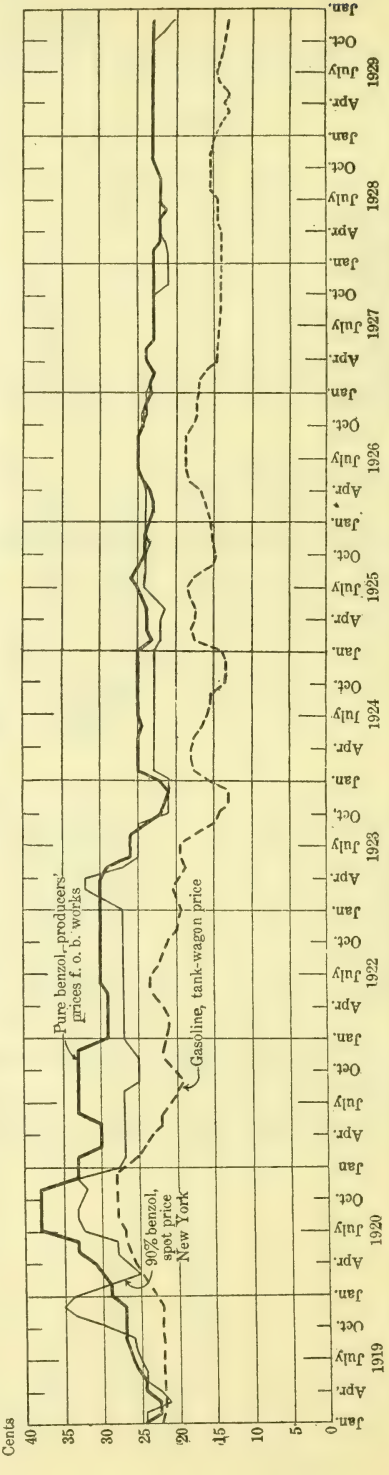

FIGURE 34.—Average price of 90 per cent benzol in New York, producers' price of pure benzol f. o. b. works, and tank-wagon price of gasoline, by months, 1919-1929

TABLE 87.—*Producers' price per gallon of pure benzol f. o. b. works and tank-wagon price of gasoline, 1925–1929, by months*

[Prices of benzol are those quoted by Steel; of tank-wagon gasoline, average for five cities computed by J. E. Pogue and published in Commerce Yearbook, 1930, vol. 1, p. 301]

Month	1925		1926		1927		1928		1929	
	Benzol	Gasoline	Benzol	Gasoline	Benzol	Gasoline	Benzol	Gasoline	Benzol	Gasoline
January	$0.250	$0.141	$0.235	$0.154	$0.235	$0.171	$0.23	$0.142	$0.23	$0.149
February	.230	.175	.230	.159	.235	.168	.23	.142	.23	.138
March	.240	.180	.230	.164	.23	.159	.22	.142	.23	.131
April	.240	.175	.235	.169	.24	.149	.22	.142	.23	.136
May	.240	.174	.245	.182	.24	.149	.22	.144	.23	.139
June	.245	.181	.250	.186	.23	.145	.215	.144	.23	.144
July	.250	.184	.250	.186	.23	.146	.22	.144	.23	.146
August	.260	.177	.250	.186	.23	.143	.22	.154	.23	.143
September	.250	.151	.250	.186	.23	.142	.22	.154	.23	.138
October	.240	.148	.245	.178	.23	.142	.225	.154	.23	.136
November	.240	.150	.245	.174	.23	.142	.23	.153	.23	.133
December	.240	.152	.240	.174	.23	.142	.23	.150	.23	.131
Average	.244	.166	.242	.175	.233	.150	.223	.147	.23	.139

TABLE 88.—*Monthly spot prices of coal-tar products in New York market, 1925–1929*

[As quoted by Oil, Paint, and Drug Reporter. Figures are averages of high and low quotations for each month]

Month	Benzol (90 per cent), per gallon					Toluol, per gallon				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
January	$0.230	$0.240	$0.240	$0.210	$0.230	$0.260	$0.350	$0.350	$0.350	$0.400
February	.220	.240	.235	.210	.230	.260	.350	.350	.350	.400
March	.220	.240	.230	.215	.230	.260	.350	.350	.350	.400
April	.220	.240	.240	.220	.230	.260	.350	.350	.350	.400
May	.215	.245	.240	.220	.230	.260	.350	.350	.350	.400
June	.230	.250	.230	.220	.230	.260	.350	.350	.350	.400
July	.240	.250	.230	.220	.230	.260	.350	.350	.350	.400
August	.240	.250	.230	.220	.230	.260	.350	.350	.350	.400
September	.240	.250	.230	.220	.230	.260	.350	.350	.350	.400
October	.240	.245	.230	.225	.230	.285	.350	.350	.375	.400
November	.235	.240	.210	.230	.215	.330	.350	.350	.400	.400
December	.240	.240	.210	.230	.205	.300	.350	.350	.400	.400
Average	.225	.244	.230	.220	.227	.271	.350	.350	.375	.400

Month	Solvent naphtha, per gallon					Naphthalene flakes, per pound				
	1925	1926	1927	1928	1929	1925	1926	1927	1928	1929
January	$0.240	$0.350	$0.350	$0.350	$0.300	$0.055	$0.061	$0.045	$0.050	$0.050
February	.240	.350	.350	.350	.300	.055	.058	.045	.050	.050
March	.240	.350	.350	.325	.300	.055	.060	.045	.050	.050
April	.240	.350	.350	.300	.300	.053	.060	.045	.050	.050
May	.245	.350	.350	.300	.300	.050	.059	.045	.050	.045
June	.250	.350	.350	.300	.300	.050	.058	.045	.050	.045
July	.250	.350	.350	.300	.300	.050	.053	.045	.050	.045
August	.250	.350	.350	.300	.300	.053	.048	.045	.050	.045
September	.255	.350	.350	.300	.300	.055	.048	.045	.050	.045
October	.260	.350	.350	.300	.300	.055	.050	.048	.050	.045
November	.305	.350	.350	.300	.300	.058	.050	.050	.048	.045
December	.350	.350	.350	.300	.300	.058	.050	.050	.045	.045
Average	.260	.350	.350	.325	.300	.054	.055	.046	.048	.047

COKE-OVEN GAS

As gas is now the most valuable coke-oven by-product (fig. 32), it is given special attention in the following tables. Tables 89 to 91 give details of the quantities recovered, used, and sold in 1929, by States. Table 92 traces the disposition made of the surplus gas from year to year. (See also fig. 35.) In the period since 1923 there has been a decrease in the amount of gas used for boiler fuel and a remarkable increase in that used in open-hearth furnaces or other affiliated works and in that distributed through city mains.

A notable development in recent years has been the use of lean gases, such as producer gas or blue water gas, made from breeze or small coke, for heating the coke ovens, thereby releasing large quantities of oven gas for sale. To record the progress made in this development the bureau has collected statistics of gases used for underfiring the ovens, the results of which are shown in Table 93. Of 87 by-product plants operating in 1929, 24 reported the use of producer gas, 2 of blue water gas, and 2 of blast-furnace gas, either alone or in combination. Most of these plants continued to use oven gas for at least a portion of the time. The total quantity of producer gas fired was 90,910,673 M cubic feet; of blue water gas, 2,732,883 M cubic feet; and of blast-furnace gas, 23,933,142 M cubic feet.

The application of these lean gases to heating the ovens is one of the causes underlying the advance in the proportion of the total production of coke-oven gas available for use or sale. (See Table 94 and fig. 36.)

TABLE 89.—*Coke-oven gas produced and sold in the United States in 1929, by States*

State	Number of active plants	Produced (M cubic feet)	Used in process (M cubic feet)	Surplus sold or used			Wasted (M cubic feet)
				M cubic feet	Value		
					Total	Average	
Alabama	8	76, 185, 882	30, 598, 255	40, 025, 257	$2, 543, 410	$0. 064	5, 562, 370
Colorado	1	9, 799, 296	3, 919, 561	5, 744, 997	(1)	(1)	134, 738
Illinois	8	62, 448, 452	17, 677, 160	44, 738, 762	10, 394, 594	. 232	32, 530
Indiana	7	94, 864, 018	41, 562, 579	52, 058, 732	10, 762, 701	. 207	1, 242, 707
Maryland	1	20, 681, 193	7, 124, 124	13, 557, 069	(1)	(1)	----------
Massachusetts	3	11, 547, 556	4, 419, 530	7, 124, 709	2, 357, 840	. 331	3, 317
Michigan	7	42, 301, 852	13, 966, 137	28, 302, 294	5, 549, 603	. 196	33, 421
Minnesota	3	12, 325, 067	5, 571, 677	6, 718, 997	1, 926, 432	. 287	34, 393
New Jersey	2	14, 721, 123	2, 426, 818	12, 294, 305	(1)	(1)	----------
New York	9	67, 192, 762	17, 587, 794	47, 595, 979	14, 962, 543	. 314	2, 008, 989
Ohio	15	133, 951, 302	55, 912, 383	76, 116, 475	8, 992, 635	. 118	1, 922, 444
Pennsylvania	12	240, 552, 305	97, 282, 507	136, 629, 648	15, 172, 152	. 111	6, 640, 150
Tennessee	1	1, 575, 345	739, 109	836, 236	224, 194	. 268	----------
Utah	1	5, 433, 392	2, 499, 360	2, 403, 237	(1)	(1)	530, 795
Washington	1	661, 394	----------	613, 972	207, 746	. 338	47, 422
West Virginia	3	21, 950, 347	8, 204, 403	13, 568, 052	1, 522, 708	. 112	177, 892
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	26, 956, 803	7, 309, 225	19, 261, 858	3, 489, 275	. 181	385, 720
Undistributed	-------	----------	----------	----------	6, 198, 437	. 182	----------
Total	87	843, 148, 089	316, 800, 622	507, 590, 579	84, 304, 270	. 166	18, 756, 888
From merchant ovens	41	188, 286, 522	47, 127, 209	137, 181, 309	41, 451, 083	. 302	3, 978, 004
From furnace ovens	46	654, 861, 567	269, 673, 413	370, 409, 270	42, 853, 187	. 116	14, 778, 884

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[1] Included under "Undistributed."

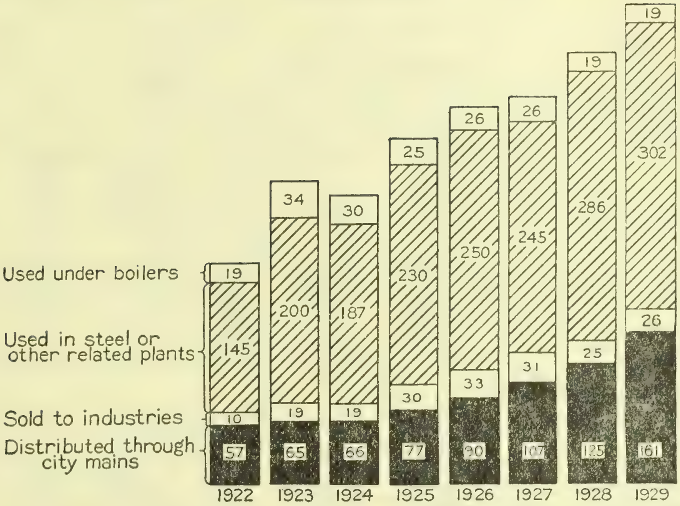

FIGURE 35.—Disposition of surplus coke-oven gas, 1922–1929. Gas used in heating ovens or wasted is not included. Figures in bars represent billion cubic feet

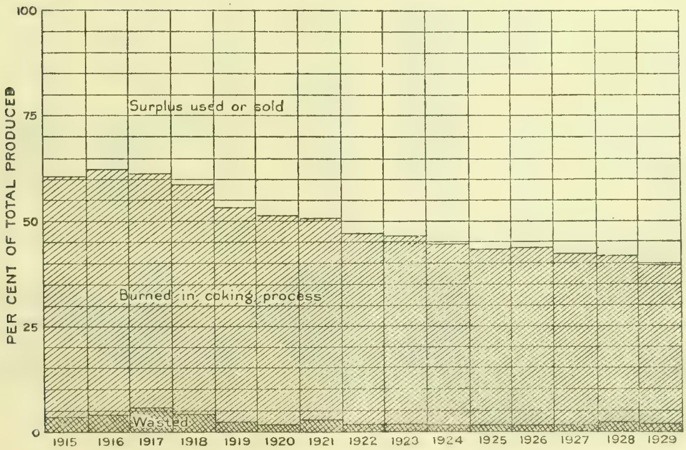

FIGURE 36.—Per cent of total production of by-product oven gas that was wasted burned in coking processes, or sold or used, 1915–1929

TABLE 90.—*Disposition of surplus coke-oven gas in the United States in 1929, by States*

State	Used under boilers			Used in steel or other affiliated plants		
	M cubic feet	Value		M cubic feet	Value	
		Total	Average		Total	Average
Alabama	8,818,745	$423,170	$0.048	25,180,785	$1,420,789	$0.056
Colorado	----------	----------	----------	5,744,997	(1)	(1)
Illinois	(1)	(1)	(1)	5,438,257	712,424	.131
Indiana	660,227	54,182	.082	40,134,899	5,682,337	.142
Maryland	----------	----------	----------	5,292,332	(1)	(1)
Michigan	(1)	(1)	(1)	(1)	(1)	(1)
Minnesota	(1)	(1)	(1)	(1)	(1)	(1)
New York	1,538,892	112,426	.073	14,857,024	1,870,054	.126
Ohio	3,432,098	459,386	.134	57,860,355	6,465,323	.112
Pennsylvania	1,164,991	106,608	.092	122,577,750	11,428,415	.093
Tennessee	154,600	5,408	.035	----------	----------	----------
Utah	217,336	(1)	(1)	1,956,021	(1)	(1)
Washington	2,572	1,916	.745	----------	----------	----------
West Virginia	(1)	(1)	(1)	10,959,179	858,245	.078
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	(1)	(1)	(1)	----------	----------	----------
Undistributed	2,517,041	119,231	----------	12,163,866	3,463,917	----------
Total	18,506,502	1,282,327	.069	302,165,465	31,901,504	.106
From merchant ovens	7,369,668	546,457	.074	969,959	154,715	.160
From furnace ovens	11,136,834	735,870	.066	301,195,506	31,746,789	.105

State	Distributed through city mains			Sold for industrial purposes		
	M cubic feet	Value		M cubic feet	Value	
		Total	Average		Total	Average
Alabama	3,109,728	$476,556	$0.153	2,915,999	$222,895	$0.076
Illinois	38,717,358	9,327,425	.241	(1)	(1)	(1)
Indiana	6,097,596	4,161,513	.682	5,166,010	864,669	.167
Maryland	8,264,737	(1)	(1)	----------	----------	----------
Massachusetts	7,051,101	2,332,151	.331	73,608	25,689	.349
Michigan	15,992,849	3,696,819	.231	(1)	(1)	(1)
Minnesota	4,371,519	1,639,345	.375	----------	----------	----------
New Jersey	12,294,305	(1)	(1)	----------	----------	----------
New York	28,164,501	12,001,841	.426	3,035,562	978,222	.322
Ohio	4,916,626	1,069,000	.217	9,907,396	998,926	.101
Pennsylvania	12,857,367	3,634,042	.283	29,540	3,087	.105
Tennessee	----------	----------	----------	681,636	218,786	.321
Utah	(1)	(1)	(1)	126,350	(1)	(1)
Washington	611,400	205,830	.337	----------	----------	----------
West Virginia	(1)	(1)	(1)	----------	----------	----------
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	15,579,498	3,101,787	.199	(1)	(1)	(1)
Undistributed	2,532,336	5,348,323	----------	4,421,590	813,533	----------
Total	160,560,921	46,994,632	.293	26,357,691	4,125,807	.157
From merchant ovens	115,934,449	38,344,102	.331	12,907,233	2,405,809	.186
From furnace ovens	44,626,472	8,650,530	.194	13,450,458	1,719,998	.128

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[1] Included under "Undistributed."

TABLE 91.—*Yield and disposal of gas and number of plants supplying gas for certain uses, by States, in 1929*

State	Yield of gas (M cubic feet) per ton of coal coked	Disposal (per cent of total)						Number of plants	
		In coke plants		To steel or other affiliated plants	For distribution through city mains	For industrial purposes	Wasted	Supplying gas for city distribution	Supplying gas to steel or other affiliated plants
		For use in heating coke ovens	For use under boilers						
Alabama	11.4	40.1	11.6	33.1	4.1	3.8	7.3	3	6
Colorado	11.8	40.0	--------	58.6	--------	--------	1.4	--------	1
Illinois	10.4	28.3	(1)	8.7	62.0	(1)	.1	8	4
Indiana	10.8	43.8	.7	42.3	6.4	5.5	1.3	5	4
Maryland	10.8	34.4	--------	25.6	40.0	--------	--------	1	1
Massachusetts	10.3	38.3	--------	--------	61.1	.6	(2)	3	--------
Michigan	11.2	33.0	(1)	(1)	37.8	(1)	.1	7	1
Minnesota	11.6	45.2	(1)	(1)	35.5	--------	.3	2	1
New Jersey	11.8	16.5	--------	--------	83.5	--------	--------	2	--------
New York	10.9	26.2	2.3	22.1	41.9	4.5	3.0	8	3
Ohio	10.9	41.7	2.6	43.2	3.7	7.4	1.4	4	12
Pennsylvania	11.1	40.4	.5	51.0	5.3	(2)	2.8	6	9
Tennessee	9.8	46.9	9.8	--------	--------	43.3	--------	--------	--------
Utah	11.0	46.0	4.0	36.0	(1)	2.3	9.8	1	1
Washington	10.0	--------	.4	--------	92.4	--------	7.2	1	--------
West Virginia	10.7	37.4	(1)	49.9	(1)	--------	.8	1	2
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	11.0	27.1	(1)	--------	57.8	(1)	1.4	4	--------
Total	11.0	37.6	2.2	35.8	19.1	3.1	2.2	56	45
From merchant ovens	11.0	25.0	3.9	.5	61.6	6.9	2.1	37	6
From furnace ovens	11.0	41.2	1.7	46.0	6.8	2.0	2.3	19	39

[1] Not at liberty to publish.

[2] Less than one-tenth of 1 per cent.

TABLE 92.—*Disposition of gas from by-product ovens in the United States, 1924–1929*

	Millions of cubic feet	Percentage of total production	Value	
			Total	Cents per M
1924				
Used under boilers	29,794	5.5	$1,729,013	5.8
Used in steel or other related plants	187,172	34.6	21,007,607	11.2
Distributed through city mains	65,677	12.1	23,486,416	35.8
Sold for industrial purposes	18,561	3.4	3,561,911	19.2
Total sold or used (not for ovens)	301,204	55.6	49,784,947	16.5
Used in heating ovens	229,298	42.4	--------	--------
Wasted	10,599	2.0	--------	--------
Total produced	541,101	100.0	--------	--------
1925				
Used under boilers	25,239	3.9	1,451,253	5.8
Used in steel or other related plants	230,030	36.0	26,380,657	11.5
Distributed through city mains	77,457	12.1	29,319,309	37.9
Sold for industrial purposes	29,528	4.6	4,333,000	14.7
Total sold or used (not for ovens)	362,254	56.6	61,484,219	17.0
Used in heating ovens	266,112	41.6	--------	--------
Wasted	11,278	1.8	--------	--------
Total produced	639,644	100.0	--------	--------
1926				
Used under boilers	25,954	3.7	1,438,699	5.5
Used in steel or other related plants	249,841	35.3	27,955,574	11.2
Distributed through city mains	89,566	12.7	29,978,997	33.5
Sold for industrial purposes	32,553	4.6	5,313,530	16.3
Total sold or used (not for ovens)	397,914	56.3	64,686,800	16.3
Used in heating ovens	296,431	42.0	--------	--------
Wasted	12,337	1.7	--------	--------
Total produced	706,682	100.0	--------	--------

TABLE 92.—*Disposition of gas from by-product ovens in the United States, 1924–1929*—Continued

	Millions of cubic feet	Percentage of total production	Value	
			Total	Cents per M
1927				
Used under boilers	25,849	3.7	$1,866,342	7.2
Used in steel or other related plants	244,969	34.9	26,580,340	10.9
Distributed through city mains	106,910	15.2	36,249,081	33.9
Sold for industrial purposes	30,661	4.4	5,396,405	17.6
Total sold or used (not for ovens)	408,389	58.2	70,092,168	17.2
Used in heating ovens	280,771	40.1		
Wasted	11,735	1.7		
Total produced	700,895	100.0		
1928				
Used under boilers	18,620	2.4	1,132,547	6.1
Used in steel or other related plants	286,133	36.9	31,509,424	11.0
Distributed through city mains	125,132	16.1	39,935,641	31.9
Sold for industrial purposes	24,588	3.2	3,921,245	15.9
Total sold or used (not for ovens)	454,473	58.6	76,498,857	16.8
Used in heating ovens	302,748	39.0		
Wasted	18,292	2.4		
Total produced	775,513	100.0		
1929				
Used under boilers	18,507	2.2	1,282,327	6.9
Used in steel or other related plants	302,165	35.8	31,901,504	10.6
Distributed through city mains	160,561	19.1	46,994,632	29.3
Sold for industrial purposes	26,358	3.1	4,125,807	15.7
Total sold or used (not for ovens)	507,591	60.2	84,304,270	16.6
Used in heating ovens	316,800	37.6		
Wasted	18,757	2.2		
Total produced	843,148	100.0		

TABLE 93.—*Recapitulation of all gases used in heating by-product coke ovens, 1928 and 1929*

[Some plants using producer gas were unable to specify the exact amount. For these estimates have been supplied, assuming 130 B. t. u. per cubic foot of producer gas]

	Coke-oven gas	Producer gas	Blue water gas	Blast-furnace gas	Total
1928					
Number of plants using gas specified:					
Furnace plants	46	1	1	1	[1] 46
Other plants	33	17	4	1	[1] 39
Total	79	18	5	2	[1] 85
M cubic feet of gas used in heating ovens:					
Furnace plants	257,542,376	62,652,204	2,391,378	3,948,393	259,615,340
Other plants	45,206,152				112,125,163
Total	302,748,528	62,652,204	2,391,378	3,948,393	371,740,503
1929					
Number of plants using gas specified:					
Furnace plants	46	3		1	[1] 46
Other plants	36	21	2	1	[1] 41
Total	82	24	2	2	[1] 87
M cubic feet of gas used in heating ovens:					
Furnace plants	269,673,413	5,932,110		23,933,142	275,994,196
Other plants	47,127,209	84,978,563	2,732,883		158,383,124
Total	316,800,622	90,910,673	2,732,883	23,933,142	434,377,320

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[1] As some plants use a combination of one or more other gases with coke-oven gas, the net totals are less than the sum of the entries in the preceding columns.

TABLE 94.—*Disposition of gas from by-product coke ovens, 1915–1929, in per cent*

Year	Wasted	Burned in coking process	Surplus sold or used (not for ovens)	Year	Wasted	Burned in coking process	Surplus sold or used (not for ovens)
1915	3.2	57.3	39.5	1923	2.1	44.9	53.0
1916	4.0	58.4	37.6	1924	2.0	42.4	55.6
1917	5.4	55.7	38.9	1925	1.8	41.6	56.6
1918	4.1	54.8	41.1	1926	1.8	42.0	56.3
1919	2.6	51.0	46.4	1927	1.7	40.1	58.2
1920	2.2	49.5	48.3	1928	2.4	39.0	58.6
1921	2.9	47.4	49.7	1929	2.2	37.6	60.2
1922	1.9	45.9	52.2				

TABLE 95.—*Trend in prices of gas per M cubic feet, 1913–1929*

Year	Average price to householders [1]		Average value of all gas sold [2]		
	Manufactured gas (44 cities)	Natural gas (8 cities)	Natural gas [3]	Coal, oil, and water gas	Coke-oven surplus gas [4]
1913	$0.95	$0.34	$0.151	[5] $0.91	$0.088
1914	.94	.34	.159	(6)	.098
1915	.93	.34	.161	.91	.102
1916	.92	.34	.160	(6)	.098
1917	.91	.35	.179	.87	.087
1918	.95	.39	.213	.91	.087
1919	1.04	.44	.216	(6)	.086
1920	1.09	.44	.246	1.06	.140
1921	1.32	.49	.264	[7] 1.21	.168
1922	1.29	.54	.291	1.16	.167
1923	1.25	.55	.238	[7] 1.11	.162
1924	1.24	.59	.222	(6)	.165
1925	1.23	.65	.223	[7] 1.10	.170
1926	1.23	.66	.229	(6)	.163
1927	1.22	.66	.220	[7] 1.08	.172
1928	1.21	.66	.232	(6)	.168
1929	1.22	.66	.215	(6)	.166

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[1] Average of prices in effect on or near June 15; from statistics of prices published by the Bureau of Labor Statistics. The figures for manufactured gas are the average net price per 1,000 cubic feet when 3,000 cubic feet is purchased, which amount the Bureau of Labor Statistics estimates to be the consumption of a typical family. Similarly the figures for natural gas are the average net price per 1,000 cubic feet when 5,000 cubic feet is purchased.

[2] As reported by operators to the Bureau of Mines.

[3] Average value of all natural gas at point of consumption or at town border when sold to local distributing company.

[4] Includes value of gas used by producer (not for ovens).

[5] Represents 1912.

[6] No report.

[7] Average value of all gas sold by city gas plants as reported by the Census of Manufactures, including coke-oven gas used for city distribution.

TABLE 96.—*Total sales of gas fuel in the United States, 1913–1929*

[Does not include producer gas, blast-furnace gas, Pintsch gas, or acetylene. Heating values used represent gross value]

Year	Quantity sold (billion cubic feet)				Rough equivalent in heating value (billion B. t. u.)			
	1 Surplus coke-oven gas	2 Coal, oil, and water gas	3 Natural gas, all uses	4 Total	5 Surplus coke-oven gas (1×550)	6 Coal, oil, and water gas (2×575)	7 Natural gas (3×1,075)	8 Total (5+6+7)
QUANTITY								
1913	64	[1] 166	582	812	35, 200	95, 450	626, 000	756, 650
1914	61	174	592	827	33, 550	100, 050	636, 000	769, 600
1915	84	[1] 182	629	895	46, 200	104, 650	676, 000	826, 850
1916	110	196	753	1, 059	60, 500	112, 700	810, 000	983, 200
1917	131	[1] 211	795	1, 137	72, 050	121, 325	855, 000	1, 048, 375
1918	158	234	721	1, 113	86, 900	134, 550	775, 000	996, 450
1919	193	[1] 248	746	1, 187	106, 150	142, 600	802, 000	1, 050, 750
1920	230	262	798	1, 290	126, 500	150, 650	858, 000	1, 135, 150
1921	154	[2] 269	662	1, 085	84, 700	154, 675	712, 000	951, 375
1922	231	257	763	1, 251	127, 050	147, 775	820, 000	1, 094, 825
1923	318	[2] 258	1, 007	1, 583	174, 900	148, 350	1, 082, 000	1, 405, 250
1924	301	[3] 260	1, 142	1, 703	165, 550	149, 500	1, 227, 000	1, 542, 050
1925	362	[2] 283	1, 189	1, 834	199, 100	162, 725	1, 278, 175	1, 640, 000
1926	398	[3] 290	1, 313	2, 001	218, 900	166, 750	1, 411, 475	1, 797, 125
1927	408	[4] 300	1, 445	[4] 2, 153	224, 400	[4] 172, 500	1, 553, 375	[4] 1,950, 275
1928	454	[5] 300	1, 568	2, 322	249, 700	172, 500	1, 685, 600	2, 107, 800
1929	508	[3] 280	1, 917	2, 705	279, 400	161, 000	2, 060, 800	2, 501, 200
PER CENT								
1913	7. 9	20. 5	71. 6	100. 0	4. 7	12. 6	82. 7	100. 0
1914	7. 4	21. 0	71. 6	100. 0	4. 4	13. 0	82. 6	100. 0
1915	9. 4	20. 3	70. 3	100. 0	5. 6	12. 6	81. 8	100. 0
1916	10. 4	18. 5	71. 1	100. 0	6. 2	11. 5	82. 3	100. 0
1917	11. 5	18. 6	69. 9	100. 0	6. 9	11. 6	81. 5	100. 0
1918	14. 2	21. 0	64. 8	100. 0	8. 7	13. 5	77. 8	100. 0
1919	16. 3	20. 9	62. 8	100. 0	10. 1	13. 6	76. 3	100. 0
1920	17. 8	20. 3	61. 9	100. 0	11. 1	13. 3	75. 6	100. 0
1921	14. 2	24. 8	61. 0	100. 0	8. 9	16. 3	74. 8	100. 0
1922	18. 5	20. 5	61. 0	100. 0	11. 6	13. 5	74. 9	100. 0
1923	20. 1	16. 3	63. 6	100. 0	12. 4	10. 6	77. 0	100. 0
1924	17. 7	15. 3	67. 0	100. 0	10. 7	9. 7	79. 6	100. 0
1925	19. 7	15. 4	64. 9	100. 0	12. 1	9. 9	78. 0	100. 0
1926	19. 9	14. 5	65. 6	100. 0	12. 2	9. 3	78. 5	100. 0
1927	[4] 19. 0	[4] 13. 9	[4] 67. 1	100. 0	11. 5	[4] 8. 8	[4] 79. 7	100. 0
1928	19. 5	12. 9	67. 6	100. 0	11. 9	8. 2	79. 9	100. 0
1929	18. 8	10. 4	70. 8	100. 0	11. 2	6. 4	82. 4	100. 0

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[1] Estimated by assuming a uniform rate of increase between successive years reported.

[2] Total sales of manufactured gas by city gas companies as reported by the Bureau of the Census minus gas purchased for mixing and resale minus sales of gas made in by-product ovens operated by city gas companies as determined by a special retabulation made by the Bureau of Mines in 1927.

[3] Estimated.

[4] Revised since last report. The figure given is the total production of coal, oil, and water gas as reported by the Bureau of the Census minus 7.5 per cent to allow for gas unaccounted for and used by producing company.

[5] Estimated; subject to revision.

NAPHTHALENE

TABLE 97.—*Naphthalene sold by by-product coke operators, 1918–1929*

Year	Quantity (pounds)			Value	Average receipts per pound (cents)		Receipts per ton of coke (cents)
	Crude	Refined	Total		Crude	Refined	
1918	10, 403, 758	5, 486, 689	15, 890, 447	$650, 229	2. 8	6. 6	2. 5
1919	4, 038, 455	2, 663, 585	6, 702, 040	191, 364	2. 0	4. 1	. 8
1920	11, 507, 703	2, 941, 059	14, 448, 762	487, 974	2. 7	6. 1	1. 6
1921	1, 652, 466	331, 057	1, 983, 523	59, 335	2. 5	5. 6	. 3
1922	3, 298, 851	1, 589, 084	4, 887, 935	131, 252	1. 6	5. 0	. 5
1923	10, 047, 427	1, 198, 206	11, 245, 633	239, 699	1. 7	5. 5	. 6
1924	7, 891, 116	327, 957	8, 219, 073	128, 208	1. 5	3. 6	. 4
1925	9, 692, 185	208, 332	9, 900, 517	97, 493	1. 0	2. 5	. 2
1926	7, 556, 372	166, 851	7, 723, 223	97, 310	1. 3	(1)	. 2
1927	7, 848, 224	--------------	7, 848, 224	86, 078	1. 1	--------------	. 2
1928	[2] 10, 937, 429		10, 937, 429	135, 693	[2] 1. 2		. 3
1929	[2] 19, 659, 367		19, 659, 367	320, 272	[2] 1. 6		. 6

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[1] Quantity sold too small to be representative.

[2] Crude and refined not separated.

TABLE 98.—*Total commercial production of naphthalene from all sources in the United States and imports, 1918–1929*

[Total sales are shown for coke plants and gas works to avoid double counting in production of crude and refined]

	By-product coke ovens; sales of crude and refined	City gas works; sales of crude and refined	Tar distilleries and all other establishments	Total commercial production
Quantity (pounds):				
1918	15, 890, 447	896, 080	40, 138, 092	56, 924, 619
1919	6, 702, 040	(1)	12, 612, 203	20, 114, 243
1920	14, 448, 762	1, 760, 293	26, 393, 411	42, 602, 466
1921	1, 983, 523	(1)	16, 949, 464	19, 432, 987
1922	4, 887, 935	(1)	19, 323, 393	25, 411, 328
1923	11, 245, 633	1, 115, 563	41, 453, 002	53, 814, 198
1924	8, 219, 073	(1)	34, 683, 803	44, 102, 876
1925	9, 900, 517	1, 266, 037	34, 135, 175	45, 301, 729
1926	7, 723, 223	(1)	45, 165, 957	53, 059, 180
1927	7, 848, 224	(1)	45, 298, 441	53, 176, 665
1928	10, 937, 429	(1)	35, 179, 996	46, 157, 425
1929	19, 659, 367	(1)	19, 501, 679	39, 201, 046
Value:				
1918	$650, 229	$14, 282	$1, 281, 440	$1, 945, 951
1919	191, 364	(1)	327, 201	542, 565
1920	487, 974	63, 449	791, 403	1, 342, 826
1921	59, 335	(1)	380, 167	462, 502
1922	131, 252	(1)	352, 957	536, 209
1923	239, 699	42, 247	652, 148	934, 094
1924	128, 208	(1)	441, 333	602, 541
1925	97, 493	34, 751	519, 773	652, 017
1926	97, 310	(1)	494, 986	594, 296
1927	86, 078	(1)	470, 806	557, 884
1928	135, 693	(1)	395, 059	531, 752
1929	320, 272	(1)	366, 491	687, 763

	Imports of crude (free) [2]	Imports of refined (dutiable) [2]	Total imports [2]	Total produced and imported	Average spot price of flake in New York (cents per pound)
Quantity (pounds):					
1918	3, 902, 731	2, 795	3, 905, 526	60, 830, 145	
1919	3, 239, 256	7, 650	3, 246, 906	23, 361, 149	
1920	15, 012, 096	3, 697, 562	18, 709, 658	61, 312, 124	
1921	4, 495, 806	441, 685	4, 937, 491	24, 370, 478	
1922	3, 144, 332	75, 680	3, 220, 012	28, 631, 340	
1923	20, 992, 439	9, 605	21, 002, 044	74, 816, 242	
1924	5, 266, 708	4, 549	5, 271, 257	49, 374, 133	
1925	1, 979, 612		1, 979, 612	47, 281, 341	
1926	6, 962, 719	424	6, 963, 143	60, 022, 323	
1927	6, 576, 500	18, 668	6, 595, 168	59, 771, 833	
1928	19, 926, 289	27	19, 926, 316	66, 083, 741	
1929	35, 007, 419		35, 007, 419	74, 208, 465	
Value:					
1918	$130, 098	$171	$130, 269	$2, 076, 220	9. 9
1919	92, 265	384	92, 649	635, 214	7. 6
1920	530, 219	416, 172	946, 391	2, 289, 217	12. 7
1921	135, 943	31, 458	167, 401	629, 903	7. 2
1922	54, 029	7, 684	61, 713	597, 922	6. 1
1923	575, 563	194	575, 757	1, 509, 851	7. 5
1924	96, 491	1, 147	97, 638	700, 179	5. 5
1925	26, 593		26, 593	678, 610	5. 4
1926	126, 088	125	126, 213	720, 509	5. 5
1927	131, 436	3, 077	134, 513	692, 397	4. 6
1928	357, 679	6	357, 685	889, 437	4. 8
1929	598, 718		598, 718	1, 286, 481	4. 7

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[1] Data lacking or incomplete. Estimate included in total.

[2] Imports entered for consumption, compiled from records of the Bureau of Foreign and Domestic Commerce.

CREOSOTE OIL AND PITCH

The addition of creosote oil to the list of by-products is the most striking development in by-product recovery during recent years. In 1928 coke operators reported a production of 12,386,000 gallons of creosote oil and in 1929 of 26,730,126 gallons. Included in this total is the output of the tar refinery at the Clairton (Pa.) by-product plant. The carbolic oils, phenols, and cresylic acid of this plant are included in the statistics of the Tariff Commission, but the light-oil products and the creosote oil are included in the compilations of the Bureau of Mines. In addition to Clairton, 12 other by-product plants were producing creosote oil by fractional condensation in stills of a new continuous type.[8]

A considerable part of the creosote oil reported was in coal-tar solution rather than distillate as such. No separation of the two grades was asked for in the questionnaire used by the bureau, and operators naturally reported the two jointly. The sales amounted to 23,938,431 gallons, and the average price obtained was $0.096 per gallon.

The quantity of pitch produced was 88,158 tons, including pitch from the tar refinery at Clairton. Most of it was mixed with virgin tar and burned about the plant as fuel. A total of 5,599 tons was reported as sold at an average price of $4.87 a ton.

PHENOL, SULPHUR, AND MISCELLANEOUS PRODUCTS

Research in the utilization of waste materials has recently developed two other by-products, which were recovered in small amounts only in 1929 but may assume larger proportions in the future.

Crude phenols.—Four plants reported the recovery of crude phenol from ammonia-still wastes in 1929. The quantity obtained was 84,683 gallons, of which 78,869 gallons was sold for an average price of $0.36 a gallon. (See Table 70.) The development is described by Fieldner as follows:[9]

> Another example of solving a troublesome waste-disposal problem with at least a partial credit from a saleable by-product is the dephenolizing of ammonia-still wastes. Most coke-oven plants use the direct system of ammonia recovery. Such plants produce an average of 30 gallons of still waste per ton of coal carbonized. Plants using the indirect system produce about 90 gallons per ton. Total phenols (including cresols and other phenol derivatives) in ammonia-still wastes from direct-recovery plants average about 2 grams per liter (0.017 pound per gallon) but may be as high as 4 grams in some cases.[10]
>
> The discharge of such untreated still waste into a public water supply is objectionable because the phenols give rise to a disagreeable taste in the water. Modern water supplies are usually chlorinated. The chlorophenols produced in this process give a medicinal taste to the water even in dilutions as high as 50 or 100 parts per million.
>
> Three different processes have been developed and are now in use at a number of plants for removing the phenols from this waste water. Two of the processes (the Heffner-Tiddy process and the Koppers vapor recirculation process) depend on removing the phenols in the vapor phase and the third extracts the phenols with solvents * * *.
>
> The amount of saleable phenols recovered varies somewhat with the type of recovery process used and coke-oven plant conditions. An average figure for American plants is 0.35 pound per ton of coal carbonized. * * * Additional plants installed or contracted for have a potential capacity of 250,000,000 gallons of ammonia liquor, corresponding to 3,000,000 pounds of phenol annually. It is probable that the amount of phenol from this source will increase considerably as new dephenolizing plants are completed. In the Ruhr district of Germany 12 dephenolizing plants are treating 528,000,000 gallons of ammonia liquor

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[8] Cooke, F., The Direct Recovery of Standard Road Tar and Other Tar Constituents of Coal Distillation Gases by Fractional Condensation: Gas World, London, vol. 92, 1930, supplement, pp. 13-16.

[9] Fieldner, A. C., Recent Developments in By-Products from Bituminous Coal: Rept. of Investigations 3079, Bureau of Mines, 1931, p. 8.

[10] Powell, A. R., Report of Subcommittee on the Disposal of Wastes from Gas Plants: Proc. Am. Gas. Assoc., 1929, pp. 928-933.

Hatch, B. F., Phenol Recovery at By-Product Coke Plants: Blast Furnace and Steel Plant, vol. 17, 1929, pp. 1493-6, 1510, 1797-1804; vol. 18, 1930, pp. 618-9, 621.

annually and producing 6,600,000 pounds of phenol. In this connection it is interesting to note that the combined United States production of natural phenol from coal tar (not including phenol from ammonia liquor) and synthetic phenol in 1929 was 24,000,000 pounds, as compared with 10,000,000 pounds in 1928. More than 80 per cent of the production was made synthetically from benzene.

Sulphur.—Several plants reported the recovery of sulphur or brimstone in 1929. The figures of production may not be published, but the development is described by Fieldner as follows:[11]

> The recovery of sulphur in marketable quantities in connection with gas purification is one of the notable achievements of recent years. Several plants in the United States have installed such processes. In 1929, the average recovery was 2.6 pounds of sulphur per ton of coal carbonized and the sales value as ordinary brimstone was approximately $18 a ton. * * * Ordinary sulphur or brimstone is one of our cheapest commodities. * * * Consequently, the returns from this by-product, while significant, do not pay the expense of purification. However, modern chemical research can aid the by-product coke industry as well as its competitors. The research organizations of American coke-oven builders have tackled the various problems of the industry with courage and intelligent vision. One of their outstanding accomplishments has been the mechanical and chemical improvement of gas-purification processes, and especially the development of new by-products from the impurities which have been removed. Flotation sulphur, as distinguished from ordinary sulphur, is one of these new products. It is called flotation sulphur because it separates out in the purification process in an extremely finely divided or colloidal form and floats to the top of the purification liquid in the form of a froth. Due to its fineness of particle size, this form of sulphur has been found to be especially well adapted to use as a fungicide in spray or dust form. It also has been found to have curative effects on simple forms of skin disease when used as a constituent in soap.

Miscellaneous products.—Other by-products reported in 1929 included small amounts of sodium prussiate, carbolate, smoke compound, extil covering, and tar paint. (See Table 70.)

TOTAL PRODUCTION OF COAL-TAR CRUDES FROM ALL SOURCES

As explained (pp. 666 to 668), a number of the by-products of coke-oven operation are also produced at gas works or tar refineries. Table 99, prepared in collaboration with the Tariff Commission, shows the total obtained from all sources.

TABLE 99.—*Total commercial production of benzol, toluol, solvent naphtha, naphthalene, and creosote oil from all sources in the United States, 1918–1929*

[Data for coke ovens and gas works from reports to U. S. Geological Survey and Bureau of Mines; for tar refineries and others to U. S. Tariff Commission]

	By-product coke plants (sales) [1]	Gas works not elsewhere included (sales) [1 2]	Tar refineries and all other establishments [3] (production)	Total commercial production [4]
Benzol (all grades except motor benzol):				
Gallons—				
1918	43, 441, 980	2, 177, 168	3, 015. 848	48, 634, 996
1919	[5] 63, 077, 463	(6)	1, 826, 373	65, 403, 836
1920	17, 230, 776	(6)	875, 561	18, 141, 337
1921	6, 839. 021	(6)	2, 171, 631	9, 045, 642
1922	12, 256, 348	(6)	774. 940	13, 071, 288
1923	16, 724, 182	(6)	394, 906	17, 154, 088
1924	17, 740, 608	(6)	629, 934	18, 417, 542
1925	21, 816, 386	(6)	741. 576	22, 607, 962
1926	21, 987, 790	(6)	377, 048	22, 374, 838
1927	21, 193, 807	(6)	370, 782	21, 579, 589
1928	21, 452, 973	(6)	474, 457	21, 942, 430
1929	24, 558, 745	(6)	546, 268	25, 119, 013

Footnotes at end of table.

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[11] Fieldner, A. C., work cited, p. 6.

TABLE 99.—*Total commercial production of benzol, toluol, solvent naphtha, naphthalene, and creosote oil from all sources in the United States, 1918–1929*—Con.

	By-product coke plants (sales) [1]	Gas works not elsewhere included (sales) [1] [2]	Tar refineries and all other establishments [3] (production)	Total commercial production [4]
Benzol (all grades except motor benzol)—Con.				
Value—				
1918	$11,966,367	$572,950	$994,161	$13,533,478
1919	[5] 11,643,645	(6)	560,547	12,296,192
1920	4,497,823	(6)	287,586	4,794,409
1921	1,611,721	(6)	463,205	2,082,926
1922	3,435,381	(6)	215,136	3,664,517
1923	3,839,237	(6)	118,505	3,968,742
1924	3,736,656	(6)	155,973	3,901,629
1925	4,888,240	(6)	171,005	5,070,245
1926	5.067,693	(6)	105,513	5,175,206
1927	4,371,519	(6)	100,453	4,474,972
1928	4.215,752	(6)	111,805	4,330,557
1929	5,169,743	(6)	137,364	5,310,107
Motor benzol:				
Gallons—				
1919 (included under benzol above)	----------	----------	(7)	(7)
1920	[8] 55,764,265	467,126	(7)	(7)
1921	50,022,573	[9] 350,000	(7)	(7)
1922	54,930,203	(10)	(10)	55,622,482
1923	80,480,326	(6)	(10)	83,664,846
1924	72,921,244	(6)	(10)	76,072,771
1925	80,957,983	(6)	(10)	84,789,206
1926	89,501,212	(6)	(10)	92,891,995
1927	86,802,745	(6)	(10)	90,160,367
1928	102,935,995	(6)	(10)	106,574,289
1929	100,807,852	(6)	(10)	102,810,061
Value—				
1919 (included under benzol above)	----------	----------	(7)	(7)
1920	[8] $12,644,931	$112,849	(7)	(7)
1921	8,966,686	[9] 70,000	(7)	(7)
1922	10,491,309	(10)	(10)	$10,657,074
1923	13,145,833	(6)	(10)	13,851,704
1924	11,066,652	(6)	(10)	11,678,665
1925	13,441,422	(6)	(10)	14,270,746
1926	16,863,109	(6)	(10)	17,578,255
1927	14,629,999	(6)	(10)	15,201,144
1928	16,832,646	(6)	(10)	17,388,166
1929	16,063,285	(6)	(10)	16,407,442
Toluol, all grades:				
Gallons—				
1918	8,541,366	3,965,518	1,596,353	14,103,237
1919	1,353,827	(6)	510,957	1,884,784
1920	2,470,364	[9] 2.000	(11)	(11)
1921	835,493	[9] 1,000	(11)	(11)
1922	1,910.060	(11)	(11)	(11)
1923	2,634,783	[9] 2,000	(11)	(11)
1924	3,231,502	[9] 2,000	(11)	(11)
1925	5.038,147	[9] 2,000	(11)	(11)
1926	8,650,605	[9] 200	(11)	(11)
1927	11,784,984	[9] 1,000	(11)	(11)
1928	16,181,650	[9] 1,000	(11)	(11)
1929	17,064,206	[9] 1,000	(11)	(11)
Value—				
1918	$12,249,702	$5,597,353	$8,044,890	$20,891,945
1919	355,990	(6)	235,321	596,511
1920	740,722	[9] 300	(11)	(11)
1921	233,378	[9] 270	(11)	(11)
1922	557,015	(11)	(11)	(11)
1923	766,030	[9] 570	(11)	(11)
1924	769,682	[9] 500	(11)	(11)
1925	1,310,786	[9] 500	(11)	(11)
1926	2,914,752	[9] 170	(11)	(11)
1927	3,999,820	[9] 300	(11)	(11)
1928	5,513,624	[9] 300	(11)	(11)
1929	6,580,176	[9] 300	(11)	(11)
Solvent naphtha, crude and refined, including xylol:				
Gallons—				
1918	3,284,037	1,442,267	965,458	5,691,762
1919	3,649,066	(6)	(10)	4,128,747
1920	4,695.464	(6)	(10)	5,384,560
1921	2,881,656	(6)	(10)	3,627,488
1922	2,861,482	(10)	(10)	3,680,811
1923	3,399,904	(6)	(10)	4,041,497
1924	3,884,585	(6)	812,378	4,781,963
1925	3,993,735	(6)	530,833	4,609,568
1926	3,546,117	(6)	(10)	4,588,844

Footnotes at end of table.

TABLE 99.—*Total commercial production of benzol, toluol, solvent naphtha, naphthalene, and creosote oil from all sources in the United States, 1918–1929*—Con.

	By-product coke plants (sales) [1]	Gas works not elsewhere included (sales) [1] [2]	Tar refineries and all other establishments [3] (production)	Total commercial production [4]
Solvent naphtha, crude and refined, including xylol—Continued.				
Gallons—Continued.				
1927	3,661,970	(6)	(10)	4,536,967
1928	4,471,141	(6)	(10)	5,615,192
1929	6,581,047	(6)	(10)	7,896,802
Value—				
1918	$458,689	$191,475	$232,003	$882,167
1919	557.416	(6)	(10)	672,685
1920	851,048	(6)	(10)	994,205
1921	510,509	(6)	(10)	644,548
1922	538,512	(10)	(10)	773,336
1923	608,084	(6)	(10)	800,698
1924	724,874	(6)	153,941	896,815
1925	805,251	(6)	148,801	972,052
1926	1,035,870	(6)	(10)	1,174,297
1927	926,787	(6)	(10)	1,072,198
1928	1,047,095	(6)	(10)	1,201,882
1929	1,591,333	(6)	(10)	1,773,119
Naphthalene:				
Pounds—				
1918	15,890,447	896,080	40,138,092	56,924,619
1919	6,702,040	(6)	12,612,203	20,114,243
1920	14,448,762	1,760,293	26,393,411	42,602,466
1921	1,983,523	(6)	16,949,464	19,432,987
1922	4,887,935	(6)	19,323,393	25,411,328
1923	11,245,633	1,115,563	41,453,002	53,814,195
1924	8.219,073	(6)	34,683,803	44,102,878
1925	9,900,517	1,266,037	34,135,175	45,301,726
1926	7,723,223	(6)	45,165,957	53,059,189
1927	7,848,224	(6)	45,298,441	53,176,660
1928	10,937,429	(6)	35,179,996	46,157,425
1929	19,659,367	(6)	19,501,679	39,201,046
Value—				
1918	$650,229	$14,282	$1,281,440	$1,945,951
1919	191,364	(6)	327,201	542,565
1920	487,974	63,449	791,403	1,342,826
1921	59,335	(6)	380,167	462,502
1922	131,252	(6)	352,957	536,209
1923	239,709	42,247	652,148	934,104
1924	128,208	(6)	441,333	602,541
1925	97,493	34,751	519,773	652,017
1926	97,310	(6)	494,986	594,296
1927	86,078	(6)	470,806	557,884
1928	135,693	(6)	395,059	531,752
1929	320,272	(6)	366,491	687,763
Creosote oil,[12] including distillate as such and in coal-tar solution:				
Gallons—1928	[13] 12,386,000		122,074,126	134,460,126
1929	26,730,126		143,746,832	170,476,958
Value—1928	(6)		$15,894,588	$17,507,588
1929	$2,566,092		17,020,595	19,586,687

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[1] Sales instead of production are here given to avoid double counting between production of crude and pure grades and because such of the product as is used in the coke plant or gas works is not available for commercial use.

[2] In order to eliminate duplication, the figures for gas works are exclusive of by-product coke ovens operated by city gas companies, which are included in the preceding column, and exclusive of recoveries from such tar-refining operations conducted by the city gas companies as are included in the column headed "tar refineries." From time to time plants formerly included in the column headed "gas works" have been transferred to the column "tar refineries," hence the figures in the "gas works" column are not strictly comparable from year to year. The total commercial production shown in the last column contains no duplication and is comparable from year to year.

[3] See note 2.

[4] Totals include estimates for firms not reporting, and actual figures for items that can not be shown separately without disclosing individual returns.

[5] Includes motor benzol and 13,000 gallons of gasoline used in blending.

[6] Reports incomplete. Estimate included in total.

[7] Data not collected from tar refiners prior to 1922.

[8] Includes 1,333,000 gallons of gasoline used in blending.

[9] Estimate.

[10] Included in total, but can not be shown separately without disclosing individual returns.

[11] A certain quantity of toluol was produced, but the figures can not be given without disclosing individual returns.

[12] Prior to 1928, all the creosote oil reported produced came from the "Tar refineries, etc." Beginning with 1928 considerable quantities were recovered at by-product coke plants.

[13] Figures represent production.

BY-PRODUCT COKE OVENS OWNED BY CITY GAS COMPANIES, INCLUDED BY BUREAU OF THE CENSUS IN MANUFACTURED-GAS INDUSTRY

Reference has already been made (pp. 579, 580) to the group of by-product coke plants installed by city gas companies, which the Bureau of the Census classifies as a part of the "Manufactured-gas industry" and which the Bureau of Mines includes with the by-product coke industry.

The difference in classification is maintained by the two offices advisedly, in the interest of those who can use the statistics. For some purposes the Census grouping is the more useful, and for others—particuarly the design of ovens, technique of manufacture, and the supply and demand for coal and coke—the grouping used by the Bureau of Mines is the more significant.

To compare or combine the two sets of figures, however, allowance must be made for the difference in classification, which can be done by means of the data in Table 100, prepared for the purpose by the Bureau of Mines. The table shows in parallel columns separate figures for the group of by-product coke plants operated by city gas companies (grouped by the Bureau of the Census with the manufactured-gas industry) and for all other by-product coke plants. Thus, in 1929 there were 21 plants in the group owned by city gas companies, and they produced 3,232,307 tons of coke and 55,954,527 M cubic feet of gas. Corresponding figures for each year from 1918 to 1925 are given in Coke and By-Products in 1925, pages 610 to 615, and for 1926 and 1927 in Coke and By-Products in 1927, page 683. By subtracting the production from the Census figures for the manufactured-gas industry anyone interested may obtain the quantities of the several products produced by gas works proper; that is, coal, oil, and water-gas plants.

The table also shows the operations of the 66 plants not owned by city gas companies, which in 1929 produced 50,179,519 tons of coke, 787,193,562 M cubic feet of gas, 636,386,413 gallons of tar, 401,440,953 pounds of NH_3, and 198,225,478 gallons of crude light oil. This group of plants is that covered by the Census classification of "Coke, not including gas-house coke, made in by-product ovens." The figures are compiled by the Bureau of Mines from the reports of the coke producers and are accepted by the Bureau of the Census as its record of production in the years covered by the Census of Manufactures.

The totals for both groups of plants given in the last column of the table are the figures for the by-product coke industry as defined by the Bureau of Mines and given in the other tables of this report.

Both groups of by-product plants have been increasing in number and in volume of output. (See Table 101.) The number of public-utility plants rose from 9 in 1918 to 21 in 1929, and their sales of surplus gas increased in the same period from 7,450,191 to 47,866,008 M cubic feet. At the same time, however, the sales of the plants not owned by city gas companies rose from 150,908,288 M cubic feet in 1918 to 459,724,571 M in 1929. The proportion of the total output of coke-oven gas contributed by the public-utility group was 9.4 per cent in 1929, as against 4.7 per cent in 1918.

TABLE 100.—*Production of coke, breeze, gas, and by-products at by-product coke plants owned by city gas companies (public utilities) and included by Bureau of the Census in manufactured-gas industry, and at all other by-product coke plants, 1928 and 1929*

Product	1928			1929		
	Plants not owned by city gas companies	Plants owned by city gas companies (public utilities) [1]	Total	Plants not owned by city gas companies	Plants owned by city gas companies (public utilities) [1]	Total
Total value	$562, 833, 399	$63, 404, 235	$626, 237, 634	$668, 883, 040	$93, 279, 904	$762, 162, 944
Number of active plants	65	20	85	66	21	87
Coke:						
Production ... net tons	45. 568, 594	2, 744, 431	48, 313, 025	50, 179, 519	3, 232, 307	53, 411, 826
Value	$216, 635, 392	$19, 879, 812	$236, 515, 204	$233, 994, 423	$22, 435, 745	$256, 430, 168
Average value	$4. 75	$7. 24	$4. 90	$4. 46	$6. 94	$4. 80
Screenings and breeze:						
Production ... net tons	4, 119, 139	259, 100	4, 378, 239	4, 551, 255	301, 465	4, 852, 720
Sales ... do	819, 741	10, 394	830, 135	907, 765	14, 928	922, 693
Value	$2, 246, 080	$23, 865	$2, 269, 945	$2, 566, 386	$32, 392	$2, 598, 778
Average value	$2. 74	$2. 30	$2. 73	$2. 83	$2. 17	$2. 82
Coke:						
Used by producer—						
Quantity ... net tons	33, 371, 502	567, 413	33. 938, 915	36, 287, 277	753, 964	37, 041, 241
Value	$147, 128, 931	$3, 827, 697	$150, 956, 628	$154, 596, 983	$5, 547, 059	$160, 144, 042
Sales—						
Quantity ... net tons	12, 199, 859	2, 117, 524	14, 317, 383	13, 542, 563	2, 463, 268	16, 005, 831
Value	$69, 461, 996	$15, 724, 333	$85, 186, 329	$78, 162, 887	$16, 847, 228	$95, 010, 115
By-products:						
Gas—						
Production ... M cubic feet	728, 069, 672	47, 443, 267	775, 512, 939	787, 193, 562	55, 954, 527	843, 148, 089
Sales of surplus—						
Used under boilers—						
Quantity ... M cubic feet	18, 519, 842	100, 270	18, 620, 112	18, 480, 861	25, 641	18, 506, 502
Value	$1, 099, 014	$33, 533	$1, 132, 547	$1, 277, 085	$5, 242	$1, 282, 327
Used in steel or affiliated plants—						
Quantity ... M cubic feet	286, 122, 585	10, 361	286, 132, 946	302, 079, 113	86, 352	302, 165, 465
Value	$31, 503, 649	$5, 775	$31, 509, 424	$31, 879, 423	$22, 081	$31, 901, 504
Distributed through city mains—						
Quantity ... M cubic feet	87, 206, 546	37, 924, 919	125, 131, 465	114, 913, 599	45, 647, 322	160, 560, 921
Value	$21, 129, 683	$18, 805, 958	$39, 935, 641	$26, 299, 742	$20, 694, 890	$46, 994, 632
Sold for industrial use—						
Quantity ... M cubic feet	22, 796, 210	1, 791, 839	24, 588, 049	24, 250, 998	2, 106, 693	26, 357, 691
Value	$2, 922, 257	$998, 988	$3, 921, 245	$2, 920, 001	$1, 205, 806	$4, 125, 807
Tar—						
Production ... gallons	593, 935, 726	37, 909, 041	631, 844, 767	636, 386, 413	44, 477, 953	680, 864, 366
Sales—						
Quantity ... do	295, 248, 205	36, 902, 065	332, 150, 270	290, 903, 267	42, 654, 234	333, 557, 501
Value	$15, 478, 184	$2, 066, 613	$17, 544, 797	$14, 651, 832	$2, 330, 574	$16, 982, 406
Average value	$0. 052	$0. 056	$0. 053	$0. 050	$0. 055	$0. 051
Ammonia—						
Production (NH_3 equivalent of all forms) ... pounds	376, 674, 142	22, 769, 118	399, 443, 260	401, 440, 953	26, 666, 005	428, 106, 958
Liquor (NH_3 equivalent)—						
Production ... pounds	48, 758, 744	3, 710, 712	52, 469, 456	52, 302, 845	3, 725, 502	56, 028, 347
Sales ... do	48, 811, 135	3, 773, 840	52, 584, 975	51, 762, 440	3, 708, 238	55, 470, 678
Value	$2, 385, 556	$127, 756	$2, 513, 312	$2, 687, 053	$133, 749	$2, 820, 802
Sulphate—						
Production ... pounds	1, 311, 661, 590	76, 233, 624	1, 387, 895, 214	1, 396, 552, 434	91, 762, 013	1, 488, 314, 447
Sales ... do	1, 242, 078, 323	76, 291, 481	1, 318, 369, 804	1, 350, 154, 009	83, 311, 583	1, 433, 465, 592
Value	$23, 245, 960	$1, 580, 784	$24, 826, 744	$24, 174, 387	$1, 687, 092	$25, 861, 479
Crude light oil—						
Production ... gallons	186, 221, 256	2, 376, 700	188, 597, 956	198, 225, 478	2, 368, 549	200, 594, 027
Sales ... do	9, 544, 224	790, 589	10, 334, 813	10, 277, 234	813, 475	11, 090, 709
Value	$1, 062, 115	$96, 731	$1, 158, 846	$1, 271, 335	$103, 192	$1, 374, 527

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[1] Includes all by-product ovens built by city gas companies, some of which are operated in conjunction with coal, oil, and water gas plants. Does not include independent by-product plants which may sell gas to public-utility companies for distribution.

TABLE 101.—*Summary of operations of by-product plants owned by city gas companies and of all other by-product coke plants, 1918–1929*

[The plants owned by city gas companies are included by the Bureau of the Census in the manufactured-gas industry]

Year	Plants not owned by city gas companies					Plants owned by city gas companies (public utilities)				
	Number of plants	Coke produced		Surplus gas [1]		Number of plants	Coke produced		Surplus gas [1]	
		Net tons	Per cent of total by-product coke	M cubic feet	Per cent of total surplus gas		Net tons	Per cent of total by-product coke	M cubic feet	Per cent of total surplus gas
1918	51	24, 919, 395	95. 9	150, 908, 288	95. 3	9	1, 078, 185	4. 1	7, 450, 191	4. 7
1919	56	23, 894, 658	95. 1	183, 468, 750	95. 1	9	1, 242, 963	4. 9	9, 355, 344	4. 9
1920	59	29, 637, 341	96. 1	221, 032, 497	95. 9	9	1, 196, 610	3. 9	9, 383, 422	4. 1
1921	60	19, 045, 898	96. 4	148, 166, 088	96. 0	7	703, 682	3. 6	6, 134, 910	4. 0
1922	57	27, 889, 475	97. 7	226, 152, 451	97. 7	7	661, 070	2. 3	5, 230, 567	2. 3
1923	58	36, 637, 455	97. 4	310, 789, 918	97. 6	7	960, 209	2. 6	7, 652, 336	2. 4
1924	60	33, 072, 640	97. 3	292, 368, 617	97. 1	11	910, 928	2. 7	8, 835, 236	2. 9
1925	61	38, 786, 990	97. 2	350, 178, 112	96. 7	13	1, 125, 169	2. 8	12, 076, 160	3. 3
1926	62	42, 894, 780	96. 7	381, 477, 264	95. 9	15	1, 481, 806	3. 3	16, 436, 824	4. 1
1927	62	41, 924, 796	95. 5	381, 306, 485	93. 4	17	1, 959, 930	4. 5	27, 082, 872	6. 6
1928	65	45, 568, 594	94. 3	414, 645, 183	91. 2	20	2, 744, 431	5. 7	39, 827, 389	8. 8
1929	66	50, 179, 519	93. 9	459, 724, 571	90. 6	21	3, 232, 307	6. 1	47, 866, 008	9. 4

[1] Surplus gas sold or used for purposes other than heating coke ovens, exclusive of a small amount wasted.

PRODUCTION OF COKE, 1880-1929, BY STATES

TABLE 102.—*Coke produced in the United States, 1880–1929, by States, in net tons*

[1928 and 1929 production of Connecticut included under "Combined States;" no figures for other years]

Year	Alabama	Colorado	Georgia	Illinois	Indiana	Kansas	Kentucky	Maryland	Massachusetts	Michigan	Minnesota	Missouri	Montana	New Jersey	New Mexico
1880	60,781	25,568	38,041	12,700	-----	3,070	4,250	-----	-----	-----	-----	-----	-----	-----	-----
1881	109,033	48,587	41,376	14,800	-----	5,670	4,370	-----	-----	-----	-----	-----	-----	-----	-----
1882	152,940	102,105	46,602	11,400	-----	6,080	4,070	-----	-----	-----	-----	-----	-----	-----	1,000
1883	217,531	133,997	67,012	13,400	-----	8,430	5,025	-----	-----	-----	-----	-----	-----	-----	3,905
1884	244,009	115,719	79,268	13,095	-----	7,190	2,223	-----	-----	-----	-----	-----	75	-----	18,282
1885	301,180	131,960	70,669	10,350	-----	8,050	2,704	-----	-----	-----	-----	-----	175	-----	17,940
1886	375,054	142,797	82,680	8,103	6,124	12,493	4,528	-----	-----	-----	-----	-----	-----	-----	10,236
1887	325,020	170,698	79,241	9,198	17,658	14,950	14,565	-----	-----	-----	-----	2,970	7,200	-----	13,710
1888	508,511	179,682	83,721	7,410	11,956	14,831	23,150	-----	-----	-----	-----	2,600	12,000	-----	8,540
1889	1,030,510	187,638	94,727	11,583	8,301	13,910	13,021	-----	-----	-----	-----	5,275	14,043	-----	3,460
1890	1,072,942	245,756	102,233	5,000	6,013	12,311	12,343	-----	-----	-----	-----	6,136	14,427	-----	2,050
1891	1,282,496	277,074	103,057	5,200	3,798	14,174	33,777	-----	-----	-----	-----	6,872	29,009	-----	2,300
1892	1,501,571	[1] 373,229	81,807	3,170	3,207	9,132	36,123	-----	-----	-----	-----	7,299	34,557	-----	-----
1893	1,168,085	[1] 362,986	90,726	2,200	5,724	8,565	48,619	-----	-----	-----	-----	5,905	29,945	-----	5,803
1894	923,817	[1] 317,196	93,029	2,200	6,551	8,439	29,748	-----	-----	-----	-----	2,250	17,388	-----	6,529
1895	1,444,339	[1] 340,357	60,212	2,250	4,804	5,287	25,460	-----	-----	-----	-----	2,028	25,337	-----	14,663
1896	1,479,437	[1] 363,760	53,673	2,600	4,353	4,785	27,107	-----	-----	-----	-----	2,500	60,078	-----	24,228
1897	1,443,017	[1] 342,653	33,000	1,549	2,904	6,181	32,117	-----	-----	-----	-----	2,593	67,849	-----	1,438
1898	1,663,020	[1] 474,808	49,529	2,325	1,825	4,180	22,242	-----	-----	-----	-----	740	52,009	-----	6,980
1899	1,787,809	[1] 530,424	50,907	[2] 2,370	(2)	14,476	81,095	-----	(3)	-----	-----	2,860	56,376	-----	44,134
1900	2,110,837	[1] 618,755	73,928	(4)	(4)	5,948	95,532	-----	(4)	(4)	-----	2,087	54,731	-----	44,774
1901	2,148,911	[1] 671,303	54,550	(4)	(4)	7,138	100,285	-----	(4)	(4)	-----	4,749	57,004	-----	41,643
1902	2,552,246	[1] 1,003,393	82,064	(4)	(4)	20,902	126,879	-----	(4)	(4)	-----	5,780	53,463	-----	23,296
1903	2,693,497	[1] 1,053,840	85,546	(4)	(4)	14,194	115,362	(4)	(4)	(4)	-----	1,839	45,107	(4)	11,050
1904	2,340,219	[1] 789,060	75,812	4,439	(4)	9,460	64,112	(4)	(4)	(4)	(4)	2,446	41,497	(4)	58,259
1905	2,576,986	[1] 1,378,824	70,593	10,307	-----	4,425	79,487	(4)	(4)	(4)	(4)	1,580	31,482	(4)	89,638
1906	3,034,501	[1] 1,455,905	70,280	268,693	-----	1,698	74,064	(4)	(4)	(4)	(4)	-----	38,182	(4)	147,747
1907	3,021,794	[1] 1,421,579	74,934	372,697	-----	6,274	67,068	332,253	466,458	(4)	(4)	-----	40,714	256,057	265,125
1908	2,362,666	[1] 982,291	39,422	362,182	(4)	2,497	37,827	270,916	453,883	(4)	(4)	-----	(4)	248,893	274,565
1909	3,085,824	[1] 1,251,805	46,385	1,276,956	(4)	-----	46,371	315,587	444,349	(4)	(4)	-----	(4)	261,460	373,967
1910	3,249,027	[1] 1,346,211	43,814	1,514,504	(4)	(4)	53,857	335,373	450,001	(4)	(4)	-----	(4)	250,153	401,646
1911	2,761,521	[1] 1,177,023	37,553	1,610,212	(4)	(4)	66,099	343,451	477,564	(4)	(4)	-----	(4)	255,334	381,927
1912	2,975,489	972,941	43,158	1,764,944	2,616,339	(4)	191,555	304,715	511,596	(4)	(4)	-----	-----	304,715	413,906
1913	3,323,664	879,461	42,747	1,859,553	2,727,025	-----	317,084	236,423	531,384	(4)	(4)	-----	-----	255,792	467,945
1914	3,084,149	666,083	24,517	1,425,168	2,276,652	-----	443,959	87,852	540,631	(4)	(4)	-----	-----	255,283	362,572
1915	3,071,811	670,938	20,039	1,686,998	2,768,099	-----	526,097	313,283	504,438	(4)	127,847	(4)	-----	269,448	389,411
1916	4,298,417	1,053,553	47,127	2,320,400	3,489,660	-----	802,526	489,982	563,048	(4)	431,319	(4)	-----	210,766	502,812

[1] Utah included with Colorado.

[2] Indiana included with Illinois

Included with Pennsylvania.

[4] Included under "Combined States."

TABLE 102.—*Coke produced in the United States, 1880–1929, by States, in net tons*—Continued

[1928 and 1929 production of Connecticut included under "Combined States;" no figures for other years]

Year	Alabama	Colorado	Georgia	Illinois	Indiana	Kansas	Kentucky	Maryland	Massachusetts	Michigan	Minnesota	Missouri	Montana	New Jersey	New Mexico
1917	4, 892, 589	1, 112, 449	39, 589	2, 289, 833	3, 540, 718	--------	863, 071	518, 810	595, 113	(4)	490, 272	(4)	--------	423, 361	577, 679
1918	4, 352, 172	989, 447	22, 048	2, 285, 610	3, 898, 215	--------	818, 785	474, 368	556, 397	(4)	784, 065	(4)	--------	682, 148	597, 072
1919	3, 380, 771	613, 753	18, 149	1, 703, 903	3, 702, 180	--------	691, 969	356, 237	393, 331	808, 729	586, 094	(4)	--------	788, 465	260, 162
1920	4, 013, 891	789, 499	16, 523	2, 136, 793	4, 553, 697	--------	739, 577	682, 132	488, 089	1, 393, 445	674, 801	(4)	--------	725, 571	(4)
1921	2, 534, 039	368, 131	6, 943	1, 322, 178	3, 091, 263	--------	284, 825	292, 439	294, 059	777, 125	435, 866	(4)	--------	739, 768	(4)
1922	3, 799, 865	484, 039	8, 832	1, 982, 906	3, 995, 505	--------	487, 167	589, 893	407, 081	1, 142, 059	462, 044	(4)	--------	790, 811	87, 631
1923	4, 654, 075	647, 823	12, 556	3, 187, 168	5, 042, 614	--------	559, 711	861, 668	554, 125	1, 648, 773	695, 824	(4)	--------	897, 569	(4)
1924	4, 541, 058	735, 520	8, 081	2, 355, 474	4, 272, 435	--------	(4)	810, 118	397, 640	1, 770, 547	514, 764	(4)	--------	869, 120	83, 070
1925	4, 670, 481	644, 481	4, 925	3, 011, 497	5, 141, 940	--------	(4)	1, 019, 209	535, 302	1, 751, 118	518, 355	(4)	--------	903, 997	(4)
1926	(4)	790, 118	3, 059	3, 336, 962	5, 990, 344	--------	(4)	1, 120, 610	573, 748	1, 826, 638	619, 905	(4)	--------	913, 250	(4)
1927	4, 364, 354	788, 586	(4)	3, 013, 940	5, 549, 762	--------	(4)	1, 077, 309	744, 091	1, 920, 394	632, 628	(4)	--------	906, 321	--------
1928	4, 327, 324	750, 022	(4)	3, 240, 964	6, 094, 201	--------	(4)	1, 186, 398	687, 356	2, 399, 656	622, 696	(4)	--------	903, 177	--------
1929	4, 753, 967	721, 457	--------	4, 204, 116	6, 455, 378	--------	(4)	1, 393, 052	776, 679	2, 679, 971	746, 004	(4)	--------	897, 530	--------

Year	New York	Ohio	Oklahoma (Indian Territory)	Pennsylvania	Rhode Island	Tennessee	Texas	Utah	Virginia	Washington	West Virginia	Wisconsin	Wyoming	Combined States	Total
1880	--------	100, 596	1, 546	2, 821, 384	--------	130, 609	--------	1, 000	--------	--------	138, 755	--------	--------	--------	3, 338, 300
1881	--------	119, 469	1, 768	3, 437, 708	--------	143, 853	--------	--------	--------	--------	187, 126	--------	--------	--------	4, 113, 760
1882	--------	103, 722	2, 025	3, 945, 034	--------	187, 695	--------	250	--------	--------	230, 398	--------	--------	--------	4, 793, 321
1883	--------	87, 834	2, 573	4, 438, 464	--------	203, 691	--------	--------	25, 340	--------	257, 519	--------	--------	--------	5, 464, 721
1884	--------	62, 709	1, 912	3, 822, 128	--------	219, 723	--------	--------	63, 600	400	223, 472	--------	--------	--------	4, 873, 805
1885	--------	39, 416	3, 584	3, 991, 805	--------	218, 842	--------	--------	49, 139	311	260, 571	--------	--------	--------	5, 106, 696
1886	--------	34, 932	6, 351	5, 406, 597	--------	368, 139	--------	--------	122, 352	825	264, 158	--------	--------	--------	6, 845, 369
1887	--------	93, 004	10, 060	5, 832, 849	--------	396, 979	--------	--------	166, 947	14, 625	442, 031	--------	--------	--------	7, 611, 705
1888	--------	67, 194	7, 502	6, 545, 779	--------	385, 693	--------	--------	149, 199	--------	531, 762	500	--------	--------	8, 540, 030
1889	--------	75, 124	6, 639	7, 659, 055	--------	359, 710	--------	761	146, 528	3, 841	607, 880	16, 016	--------	--------	10, 258, 022
1890	--------	74, 633	6, 639	8, 560, 245	--------	348, 728	--------	8, 528	165, 847	5, 837	833, 377	24, 976	--------	--------	11, 508, 021
1891	--------	38, 718	9, 464	6, 954, 846	--------	364, 318	--------	7, 949	167, 516	6, 000	1, 009, 051	34, 387	2, 682	--------	10, 352, 688
1892	--------	51, 818	3, 569	8, 327, 612	--------	354, 096	--------	(1)	147, 912	7, 177	1, 034, 750	33, 800	--------	--------	12, 010, 829
1893	12, 850	22, 436	7, 135	6, 229, 051	--------	265, 777	--------	(1)	125, 092	6, 731	1, 062, 076	14, 958	2, 916	--------	9, 477, 580
1894	16, 500	32, 640	3, 051	6, 063, 777	--------	292, 646	--------	(1)	180, 091	5, 245	1, 193, 933	4, 250	4, 352	--------	9, 203, 632
1895	18, 521	29, 050	5, 175	9, 404, 215	--------	396, 790	286	(1)	244, 738	15, 129	1, 285, 206	4, 972	4, 895	--------	13, 333, 714
1896	(3)	80, 868	21, 021	[5] 7, 356, 502	--------	339, 202	--------	(1)	268, 081	25, 949	1, 649, 755	5, 332	19, 542	--------	11, 788, 773
1897	(3)	95, 087	30, 364	[5] 8, 966, 924	--------	368, 769	394	(1)	354, 067	26, 189	1, 472, 666	17, 216	24, 007	--------	13. 288, 984
1898	(3)	85, 535	34, 110	[5]10, 715, 302	--------	394, 545	--------	(1)	531, 161	30, 197	1, 925, 071	35, 280	18, 350	--------	16, 047. 209
1899	(3)	83, 878	24, 339	[6]13, 577, 870	--------	435, 308	--------	(1)	618, 707	30, 372	2, 278, 577	33, 437	15, 630	--------	19, 668. 509
1900	(4)	72, 116	38, 141	13, 357, 295	--------	475, 432	--------	(1)	685, 156	33, 387	2, 358, 499	(4)	(4)	506, 730	20, 533. 348
1901	(4)	108, 774	37, 374	14, 355, 917	--------	404, 017	--------	(1)	907, 130	49, 197	2, 283, 700	(4)	(4)	564, 191	21, 795, 883

1902	(4)	146,099	49,441	16,497,910	--------	560,006	--------	(1)	1,124,572	40,305	2,516,505	(4)	(4)	598,869	25,401,730
1903	(4)	143,913	49,818	15,650,932	--------	546,875	--------	(1)	1,176,439	45,623	2,707,818	(4)	(4)	932,428	25,274,281
1904	(4)	109,284	44,808	14,861,064	--------	379,240	--------	(1)	1,101,716	45,432	2,283,086	(4)	(4)	1,451,172	23,661,106
1905	(4)	277,130	54,781	20,573,736	--------	468,092	--------	(1)	1,499,481	53,137	3,400,593	(4)	(4)	1,660,857	32,231,129
1906	(4)	293,994	49,782	23,060,511	--------	483,428	--------	(1)	1,577,659	45,642	3,713,514	(4)	(4)	2,085,617	36,401,217
1907	385,478	270,634	19,089	26,513,214	--------	467,499	--------	(1)	1,545,280	52,028	4,112,896	(4)	--------	1,088,493	40,779,564
1908	473,569	159,578	2,944	15,511,634	--------	214,528	--------	(1)	1,162,051	38,889	2,637,123	(4)	--------	798,060	26,033,518
1909	523,551	222,711	(4)	24,905,525	--------	261,808	--------	(1)	1,347,478	42,981	3,943,948	(4)	--------	964,359	39,315,065
1910	652,459	282,315	(4)	26,315,607	--------	322,756	--------	(1)	1,493,655	59,337	3,803,850	(4)	--------	1,134,245	41,708,810
1911	686,172	311,382	--------	21,923,935	--------	330,418	--------	(1)	910,411	40,180	2,291,049	(4)	--------	1,947,258	35,551,489
1912	794,618	388,669	--------	27,438,693	--------	370,076	--------	(4)	967,947	49,260	2,465,986	(4)	--------	1,408,992	43,983,599
1913	758,486	351,846	--------	28,753,444	--------	364,578	--------	(4)	1,303,603	76,221	2,472,752	(4)	--------	1,577,522	46,299,530
1914	457,370	521,638	--------	20,258,393	--------	264,127	--------	(4)	780,984	84,923	1,427,962	(4)	--------	1,593,651	34,555,914
1915	684,461	684,658	--------	25,622,862	--------	256,973	--------	(4)	629,807	136,552	1,391,446	(4)	--------	1,825,982	41,581,150
1916	775,014	1,803,268	--------	31,279,695	--------	382,175	--------	(7)	1,242,332	[7] 534,653	2,521,309	(4)	--------	1,785,529	54,533,585
1917	993,184	3,694,302	--------	27,912,025	--------	411,326	--------	(7)	1,304,230	[7] 497,533	3,349,761	(4)	--------	2,100,983	55,606,828
1918	1,069,587	5,365,243	(4)	26,723,645	--------	427,106	--------	(4)	1,234,256	123,788	3,320,006	(4)	--------	2,754,414	56,478,372
1919	751,067	5,481,660	(4)	20,501,831	(4)	260,915	--------	(4)	930,516	62,546	1,413,932	(4)	--------	1,474,347	44,180,557
1920	1,040,192	5,701,810	--------	23,638,739	(4)	301,708	--------	(4)	1,027,788	59,395	1,828,336	(4)	--------	1,533,057	51,345,043
1921	746,916	3,028,423	--------	9,769,476	(4)	85,728	--------	(4)	280,476	27,260	397,892	(4)	--------	804,815	25,287,622
1922	1,494,992	5,011,138	--------	13,991,892	(4)	113,896	--------	172,453	378,656	31,674	919,744	(4)	--------	771,734	37,124,012
1923	1,783,948	6,473,606	(4)	25,624,286	(4)	304,511	--------	232,941	774,887	69,068	1,762,775	(4)	--------	1,189,606	56,977,534
1924	1,600,669	5,832,699	--------	16,927,437	(4)	207,475	--------	257,094	485,064	71,615	1,328,569	(4)	--------	1,201,156	44,269,605
1925	2,219,409	7,261,187	--------	19,427,603	(4)	216,488	--------	314,159	421,691	79,257	1,546,032	(4)	--------	1,579,812	51,266,943
1926	2,827,805	7,632,806	--------	21,922,976	(4)	241,034	--------	306,231	370,983	67,286	1,713,461	(4)	--------	6,608,321	56,865,537
1927	3,602,642	[8] 7,213,619	--------	16,777,291	(4)	227,120	--------	282,048	316,754	71,271	1,923,427	(4)	--------	1,680,586	51,092,143
1928	3,802,657	[8] 7,786,199	--------	16,917,355	(4)	216,925	--------	274,600	247,734	59,502	1,798,900	(4)	--------	1,490,162	52,805,828
1929	4,299,470	[8] 8,521,132	--------	[9] 19,856,968	(4)	209,166	--------	281,994	314,859	66,723	1,928,583	(4)	--------	1,776,796	59,883,845

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[1] Utah included with Colorado.
[3] Included with Pennsylvania.
[4] Included under "Combined States."
[5] Includes New York.
[6] Includes Massachusetts and New York.
[7] Utah included with Washington.
[8] By-product coke only. Beehive coke can not be shown without disclosing individual operations.
[9] A small amount of beehive coke, produced in Ohio, is included with Pennsylvania.

COAL[1]

By F. G. Tryon and L. Mann[2]

REVIEW OF INDUSTRY IN 1929

BITUMINOUS COAL

For American industry as a whole 1929 was a year of almost riotous prosperity, terminated abruptly by the stock-market crisis of October 28. Speculative fever in the security markets was accompanied to a smaller degree by expanded commodity production. The index of industrial output in manufacturing and mining, as measured by the Federal Reserve Board, stood at 119, the average for 1923–1925 being taken as 100, as against 111 in 1928. Indeed, at the peak of activity before the crisis the index climbed to 126.

The accelerated activity of general business was reflected, though rather dimly, in the market for bituminous coal. Consumption increased 4.2 per cent over 1928 and touched the highest point since the war, except for the period of the anthracite strike in 1925–26, when bituminous coal was needed to meet the shortage of domestic anthracite. Production in 1929 increased more than consumption, for in 1928 considerable of the current requirements had been met by drafts on storage. More active demand in 1929 helped to sustain price levels; and although there was a decline in average sales realization, reflecting lower wage rates in the union fields, spot prices averaged nearly the same as in 1928.

The effect of the stock-market collapse may be seen in the record of monthly production (fig. 37). Month by month up to October the output in 1929 exceeded that of the corresponding period of 1928. Production in September was 8.5 per cent higher than in 1928. In November, after the crash, production turned downward at a season when it usually increases, yet the decline was hardly sufficient to forecast the severity of the great depression that was to overshadow the market in the following year. The total output for 1929 as a whole was 534,989,000 tons, against an average of 519,000,000 tons for the five years preceding and 500,745,000 tons for 1928. In other words, production in 1929 was 3.1 per cent above the 5-year average and 6.8 per cent above that for 1928.

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[1] Work on manuscript completed May, 1931.

[2] The work incident to the preparation of coal statistics was done by the following employees of the Bureau of Mines: Compilation of the annual statistics of bituminous coal was conducted by L. Mann, with the assistance of J. M. Corse; the statistics of anthracite were compiled by H. L. Bennit; the monthly and weekly estimates of production were prepared by R. McKinney; the figures of consumption and stocks were compiled by H. O. Rogers, who also conducted the study of mechanical cleaning; the data on world production were compiled by L. M. Jones; and the tables of exports and imports were compiled from the records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey. The section on loading machines underground was written by O. E. Kiessling; that on size of company is adapted from special studies by F. G. Tryon, H. O. Rogers, and R. W. Metcalf, to be published elsewhere. W. H. Young collaborated in the writing of the market review. The anthracite section was printed in advance of the report as a whole and distributed in February, 1931, under the title "Anthracite in 1929, by H. O. Rogers, O. E. Kiessling, and H. L. Bennit."

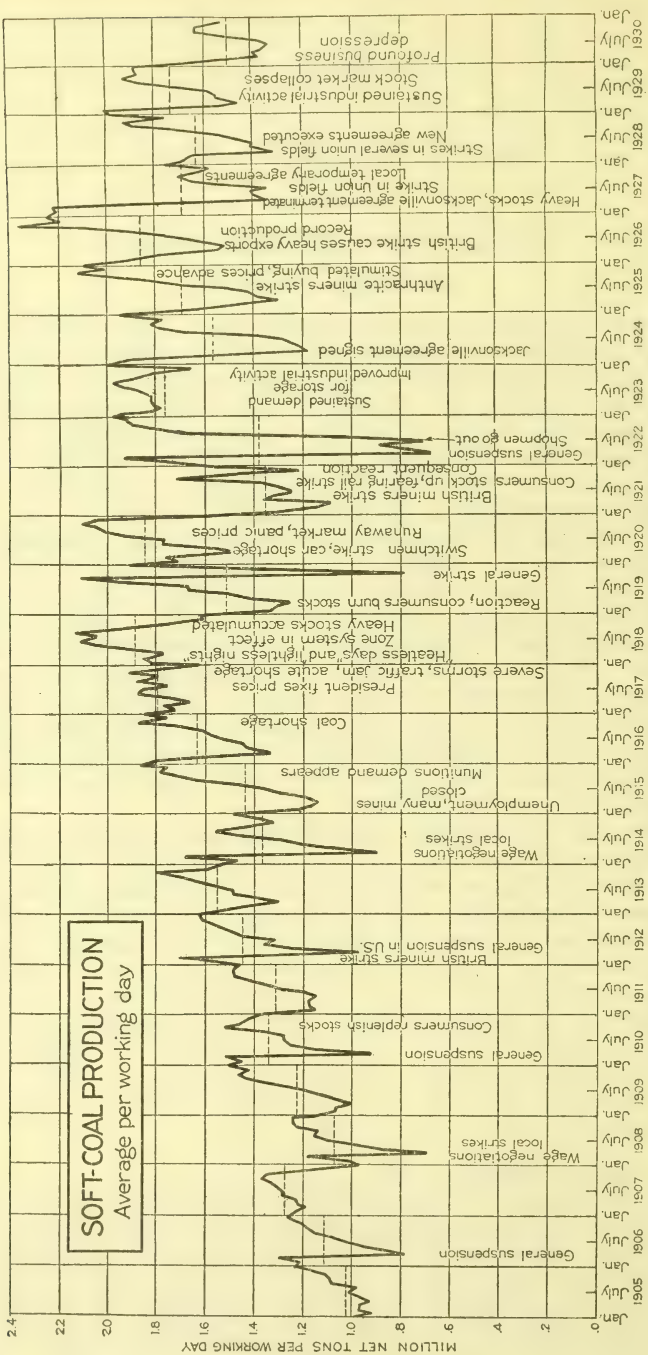

FIGURE 37.—Average production of bituminous coal per working day in each month, 1905–1929

Aside from the immediate influence of the business boom the significant developments of 1929 marked a continuation of the tendencies which have been at work throughout the period of depression in the coal industry which began in 1924.

Trend of consumers' stocks.—Stocks of consumers did not change greatly during the year. In 1928 the market had felt the pressure of the enormous reserves accumulated at the expiration of the Jacksonville wage agreement, and a total of 13,700,000 tons had been withdrawn from stock piles and applied against current requirements. By the end of 1928 liquidation of the emergency reserves had been completed, and in 1929 the movement of stocks reflected chiefly the normal influence of the seasons. (See fig. 38.) During the first half of the year consumers reduced their stock piles and in the second half rebuilt them in preparation for the winter. The year closed with a total of 40,300,000 tons in reserve, a net decrease of 1,500,000 tons in comparison with the end of 1928.

The export trade.—Exports, like domestic consumption, increased slightly in 1929. (See Table 79.) Shipments to Canada amounted to 14,645,000 tons, an increase of 4.9 per cent over the year before. Exports to the Caribbean and to Newfoundland were 1,500,000 net tons, as against an average of 1,549,000 in the 4 years preceding. In the overseas markets intense competition prevailed, chiefly from Great Britain and Germany, the abnormal conditions of 1926, in which the great strike of the British miners threw a windfall of 18,000,000 tons of extra business to American exporters, had wholly disappeared; and the combined shipments to South America, Europe, Newfoundland, Miquelon, Bermuda, and all other countries overseas totaled 1,202,000 tons, an increase of 521,000 tons over 1928 but a decrease of 1,199,000 as compared with 1925. The total exported to all destinations was 17,429,000 tons, or 3.3 per cent of the national output.

Increase in consumption.—If allowance is made for exports and changes in stocks the consumption during the year was 519,555,000 tons, an increase of 20,727,000 tons over 1928. The largest gains occurred at coke ovens, in the iron and steel and other heavy manufacturing industries, and in the generation of electric power. Most of the other classes of consumers also reported an increase. The total, however, was far less than might have been expected had the former growth of demand continued. Before the war consumption increased, with remarkable regularity, about 18,000,000 tons a year. If the former rate of growth had continued consumption to-day would be about 200,000,000 tons greater than at the time of the war. Actually, consumption in 1929 was less than in 1918, and the decrease during the 11-year period indicates once more the pressure of the competitive sources of power and the steady progress of fuel economy. Production of oil and natural gas increased notably during 1929; and although production of hydroelectricity was slightly less than in 1928, a year of unusually heavy discharge at most water-power sites, it was 16 per cent greater than in 1927. Thus, although the consumption of bituminous coal was 2 per cent less than in 1918, the production of petroleum increased 183 per cent over 1918, that of natural gas 166 per cent, and that of water power 130 per cent. (See fig. 42.) The total production of energy from all sources was 21 per cent greater than in 1918, the entire increase coming from the competitors of coal.

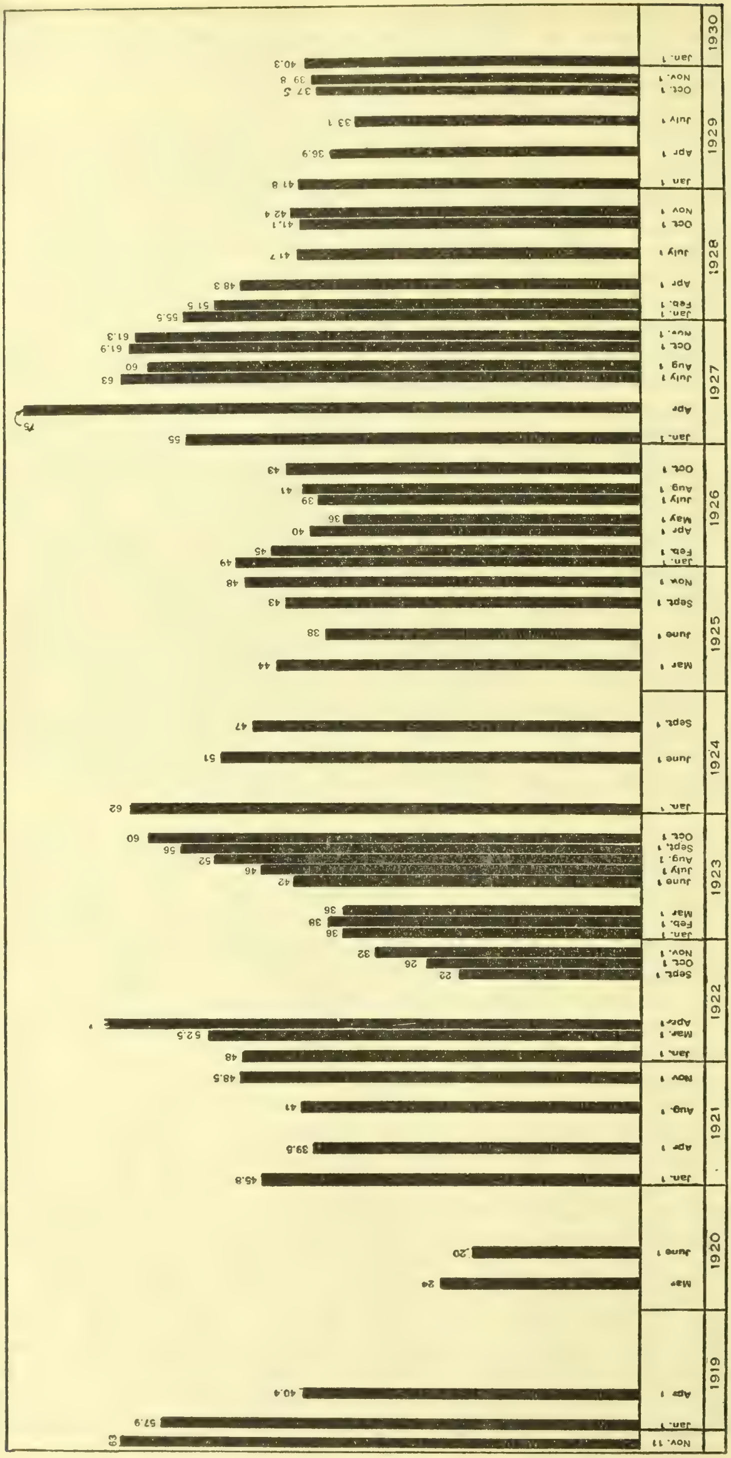

FIGURE 38.—Total commercial stocks of bituminous coal, November 11, 1918, to January 1, 1930. Coal on lake docks, in transit, and in the stores of householders is not included

Efficiency in the use of coal continued to advance during the year, all barometers showing savings as compared with 1928. Consumption per kilowatt-hour of electricity generated declined from 1.76 pounds in 1928 to 1.68 in 1929. Consumption by railroad locomotives per thousand ton-miles declined from 127 pounds to 125. Consumption of coking coal per ton of pig iron declined from 3,053 to 2,984 pounds. The extraordinary progress in fuel economy is shown most clearly by the electric utilities, which have reduced their unit consumption 47.5 per cent in the period since the war.

New record in lake cargo movement.—All records of lake coal traffic were again broken in 1929 with the loading of 39,383,842 net tons of bituminous coal at lower Lake Erie ports, an increase of 4,618,099 tons, or 13.3 per cent, over the total for 1928, the next highest year. Of the total tonnage dumped in 1929, 37,933,249 tons, or 96.3 per cent, was cargo coal and 1,450,593 tons was vessel fuel. Of the total shipments, 31,942,786 tons went to American and 6,006,854 tons to Canadian ports.

The degree to which the various fields shared the record tonnage has particular interest. In 1929 Pennsylvania supplied 7,874,443 tons of lake cargo coal, or 20.8 per cent of the total, as compared with 11 per cent in 1927. Although Pennsylvania's lake tonnage for 1929 was the largest in the past six years it was below the 8,149,733 tons for 1918. Lake shipments originating in West Virginia were 19,759,244 tons, as compared with 18,802,155 tons in 1928 and 9,155,383 tons in 1918. Eastern Kentucky supplied 6,814,482 tons, only a slight increase over 1928 but a large increase over the 1918 figure of 1,314,554 tons. Ohio supplied 1,053,032 and 3,208,528 tons in 1928 and 1929, respectively, as against 9,536,734 tons in 1918.

Prices.—The general trend of prices in 1929 was again downward. It is true that the spot market was buoyed up by the speculative activity of general business, and in October Coal Age's average of spot quotations reached $1.90. (See fig. 39.) For the year as a whole the average was $1.79, as against $1.80 in 1928.

Contract prices, on the other hand, declined largely because of the reduction in union wages toward the close of the preceding year. During the last four months of 1928 a series of district wage agreements took effect. Tonnage rates were scaled downward, but the greatest percentage reductions were made in the day rates. The old basic rate for day labor underground had been $7.50. For Illinois and Indiana the new rate was fixed at $6.10 and for Iowa at $5.80. Ohio and the Southwestern States returned to the $5 level of 1917, and somewhat similar reductions were made in other union fields. How generally these reductions in union rates were followed by further cuts in the nonunion fields is not known, but it is probable that such changes as did occur in nonunion rates were downward. The changes in average sales realizations during 1929 reflected these reductions in wage rates. In Illinois the average realization declined 13 cents a ton; in Indiana, 15 cents; in Kansas, 19 cents; and in Ohio, 18 cents. In the South the change was generally smaller, but here, too, the direction was downward; in West Kentucky the average realization declined 9 cents a ton, in East Kentucky 1 cent, and in West Virginia 4 cents.

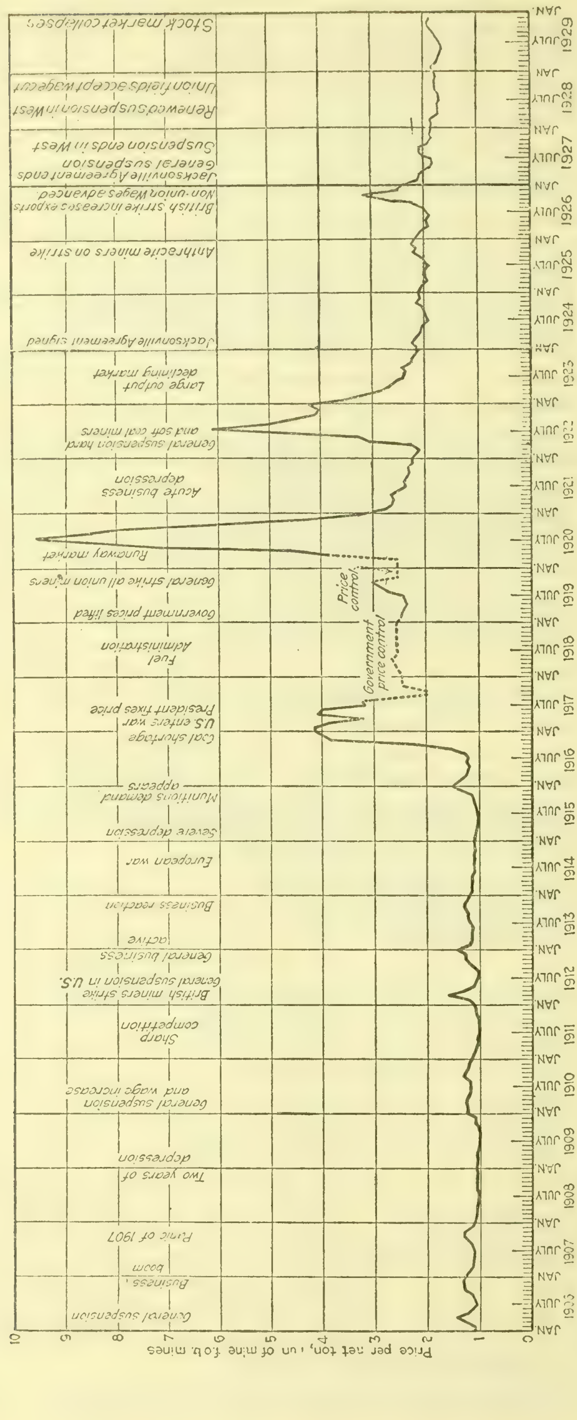

FIGURE 39.—Monthly average spot prices of bituminous coal f. o. b. mines, as quoted by Coal Age, 1906–1929

Decrease in number of men employed.—The reduction in labor force, although not as widespread as in 1928, was nevertheless serious. Nineteen thousand more men lost their jobs in 1929. Increases in the number employed in Ohio and several Western States were more than offset by declines in the other large States east of the Mississippi. The total reduction since the peak year 1923 has amounted to 202,000, and the number remaining on the pay rolls in 1929 was 502,993. It is seldom realized that the industry to-day is actually employing 69,000 fewer men than in 1913.

Further closing of mines.—There was a decrease, also, in the number of operating mines in 1929, in spite of the increase in production. The total number of commercial mines active during the year was 6,057, or 393 less than in 1928. The net reduction in the number operating since the peak year 1923 now stands at 3,274.

Increase in working time.—With fewer men and mines, those fortunate enough to remain obtained somewhat steadier employment. The average number of days operated has tended to increase in recent years, and in 1929 this tendency was augmented by the increase in demand. The average working time for the year was 219 days, the largest in any year since 1920. Although working time is still low and leaves much to be desired from the viewpoint of both capital and labor it is not far below the pre-war average. In the active year 1913 the mines worked 232 days, and the average for the 10 years ending in 1913 was only 215 days.

Progress of mechanization.—Mechanization of mining made extraordinary progress in 1929. The tonnage cut by machine rose to 75.4 per cent of the total output, a new record for the United States and probably for any country. The amount loaded mechanically underground jumped from 21,559,000 to 37,862,000 tons, an increase of 75.6 per cent in a single year. A parallel advance occurred in preparation practice. The amount cleaned mechanically by wet washing and pneumatic methods increased 29 per cent during the year and now stands at 37,143,000 tons. The growth in cleaning by pneumatic methods and by the use of launders and upward-current classifiers was especially rapid. Meanwhile, mechanization has progressed steadily in other directions, especially in underground haulage and in power drilling of shot holes. Not the least spectacular development has been the rise of open-pit mining with power shovels. From 1,281,000 tons in 1914 the quantity recovered by stripping has increased to 20,268,000 tons in 1929. Over the country as a whole the proportion recovered by stripping is only 3.8 per cent of the output; but in some of the States of the Mississippi Valley, where natural conditions are especially favorable, it rises as high as 49 per cent.

Increasing productivity per worker.—The cumulative effects of the rapid mechanization of the bituminous mines of the country are seen in the output per man per day, which increased from 4.73 tons in 1928 to 4.85 in 1929. In the 16 years since 1913 there has been a gain in the output per worker of 1.24 tons. In the 16 years preceding 1913 the gain amounted to only 0.57 ton.

The rising output per worker is a sign of engineering progress, of better management, and of more effective labor. These factors have all helped to reduce costs, thereby assisting bituminous coal to meet the competition of other sources of power. Mechanization, although so necessary, may have an unwelcome result in another direction which the industry must not ignore; where the number of men employed remains the same, mechanization tends to increase mine capacity. In 1929, however, the net change in mine capacity was downward. From 760,000,000 tons in 1928 the calculated capacity for 308 days operation declined to 752,000,000 in 1929. (See fig. 40.) The change was less than in the year preceding, but as shown by Figure 40 the reduction since the peak has been very great. In comparison with 1923, when capacity reached the maximum, there has been a net reduction of 218,000,000 tons.

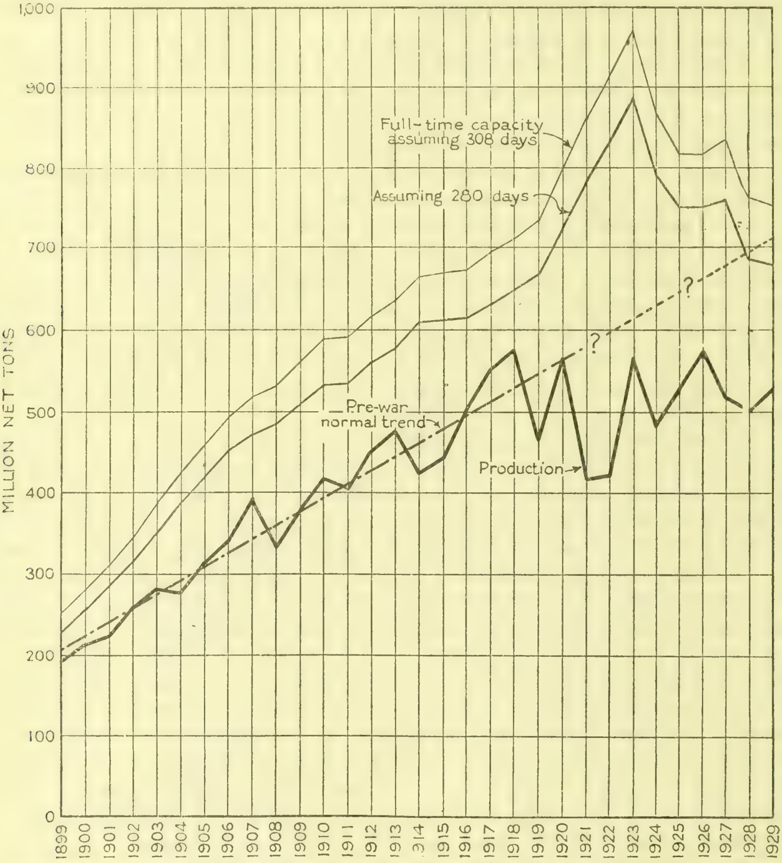

FIGURE 40.—Trend of bituminous-coal production and of mine capacity in the United States, 1899-1929

Reduction in number of operating companies.—The drastic liquidation of excess productive facilities is seen most clearly in the number of producing companies. In 1920, the year that marked the culmination of the war boom, 6,277 corporations (or partnerships or individual operators) were engaged in mining soft coal on a commercial scale, not including wagon mines. In 1929 the number had fallen to 4,612. Thus, within nine years, 1,665 commercial operators have been forced out of the bituminous-coal industry. The change has affected chiefly the middle-size producers. (See figs. 45 and 46.)

Although the number of companies in the smallest size class has declined, the mortality has been heaviest in the classes between 10,000 and 200,000 tons a year. On the other hand, the number of large companies has actually increased and with it the proportion of the tonnage they control. In 1929, there were 218 companies of over 500,000 tons, and they produced 60 per cent of the output of the country, as against only 48 per cent in 1920. The industry is still one in which a very large number of competitors struggle for a limited market, but reduction in the number of units and the concentration of tonnage among the larger units have already gone farther than is generally realized. With excess facilities thus reduced, prospects are more favorable for the stronger companies that have been able to survive.

Because of the bearing of these changes on the competitive future of the industry a special analysis was made of the 1929 returns from the standpoint of proposals for regional consolidation. The results are shown on pages 715 to 733.

PENNSYLVANIA ANTHRACITE

Much the same influences that colored the Pennsylvania anthracite industry during the two preceding years remained in evidence in 1929. Weak demand was reflected in declines both in production and prices. The total output for the year amounted to 65,918,031 gross tons, a decrease of 1,357,031 tons, or 2.0 per cent, compared with the production in 1928. In comparison with the average for the 10 years, 1920 to 1929, which amounted to 70,673,841 tons, the production in 1929 decreased 6.7 per cent.

At the beginning of the year the demand for anthracite was fairly active. In both January and February the average daily rate of production not only exceeded that of the previous year but was higher than in the corresponding months of any year since 1925. Business was somewhat curtailed, however, by an early spring; and, although stimulated when the summer discounts went into effect on April 1, the market remained far from strong. Trade continued unusually dull throughout the summer months. In fact, production for June, July, and August, amounting to only 15,428,000 tons, was the smallest for any similar period, free from major labor disturbances, in the past quarter of a century. Demand improved with the approach of the heating season, and both September and October were active months. Output fell off in November, however, with reduced requirements of the retail trade. Lower temperatures in early December revived business, and the year closed with the anthracite market in a relatively favorable position.

The condition of the anthracite trade in 1929 is probably best illustrated by a review of some of the principal markets. Detailed distribution figures are not available for the Middle Atlantic States, which comprise the most important hard-coal market, but the indications are that the industry in this area was able to hold its own. The movement in New York, Philadelphia, and other large consuming centers in the Middle Atlantic region was reasonably good throughout the greater part of the year. There was also some improvement in the export market, total shipments to foreign destinations increasing from 2,979,000 tons in 1928 to 3,041,000 tons in 1929.

Other important indicators of the trade, however, showed decreases. Receipts at Duluth-Superior continued to decline, being 401,249 tons in 1929 as against 652,095 tons in the previous year, a decrease of 38.5 per cent. The reduction in tonnage loaded into vessels at Lake Erie ports was less striking, declining from 1,420,882 tons in 1928 to 1,321,328 tons in 1929. Shipments to New England were also 337,000 tons less than in the preceding year. The total consumption for 1929, allowing for withdrawals from producers' storage yards, is placed at 63,801,000 tons, or 3 per cent under that for 1928.

The effects of the dull market conditions that prevailed throughout most of the year are shown in the course of anthracite prices. Although the large producing companies closely adhered to the circular prices, several important concessions were made. Of these, possibly the most significant was that all domestic sizes were reduced 60 cents a ton on April 1, instead of the 50-cent discount which had previously been the practice. Thus, the 10-cent monthly advances continued until October 1, whereas formerly the winter circular prices had been restored on September 1.

Another innovation in the policy of the hard-coal producers was the offering of a 2 per cent discount during the summer months for payment within 10 days of shipment, or a discount of 1 per cent for payment within 30 days. When advantage was not taken of the discount privilege, buyers were allowed 60 days in which to pay their bills. Heretofore the established terms to dealers were cash in 30 days. One large producing company even inaugurated an installment selling plan for the use of its retail customers, but this was tentatively abandoned.

In respect to prices, the independent operators closely followed the lead of the larger producers. In the New York market the average quotations on independent stove coal ranged from 5 to nearly 45 cents below the company list price, and at no time during the year were premiums paid on domestic sizes of independent coal. Quotations on independent steam sizes also remained generally below the company circular prices.

The average sales realization on shipments of breaker coal was $6.30 as against $6.38 in 1928 and $6.50 in 1927. With the exception of stove coal, which remained the same as in the previous year, all sizes shared in the general decline. The average of $8 for all domestic grades was 9 cents a ton less than in the preceding year and was the lowest for any year since 1922. The realization on the small sizes also declined, the average for all steam coal being $2.04 as compared with $2.12 in 1928.

Despite the downward trend of prices, certain factors in the anthracite situation were encouraging. Among these may be mentioned the repeal of the State tonnage tax on anthracite, the reduction of stocks and productive capacity, and finally a continuance of the vigorous and united attack by the operators upon their merchandising problems.

From the viewpoint of producers, the repeal of the special tonnage tax, which had been levied by the State since 1921, was undoubtedly one of the important developments of the year. Although the entire tax was not abolished in 1929, the measure provided that one third of the tax be removed in 1929, another third in 1930, and the last third in 1931. The reduction each year amounts to 5 cents a ton on domestic sizes and, when the act became effective on June 1, 1929, a reduction of that amount in the mine price was made by the anthracite producers.

Stocks in the hands of both producers and retail merchants at the end of December were smaller than at the beginning of the year. The tonnage stored in producers' yards was reduced by nearly 500,000 tons, the greatest decline occurring in the reserves of prepared sizes that showed a decrease of slightly more than 300,000 tons. For the steam group, producers' reserves were reduced by nearly 200,000 tons, owing chiefly to the smaller quantity of buckwheat No. 1 in storage. Moreover, reports from a representative group of coal merchants indicate that retail stocks of anthracite decreased from a supply equivalent to 54 days' requirements on January 1 to only 44 days' supply on December 31. In terms of days' supply, the stocks in retail yards at the close of 1929 were smaller than at the corresponding season of any year since 1926.

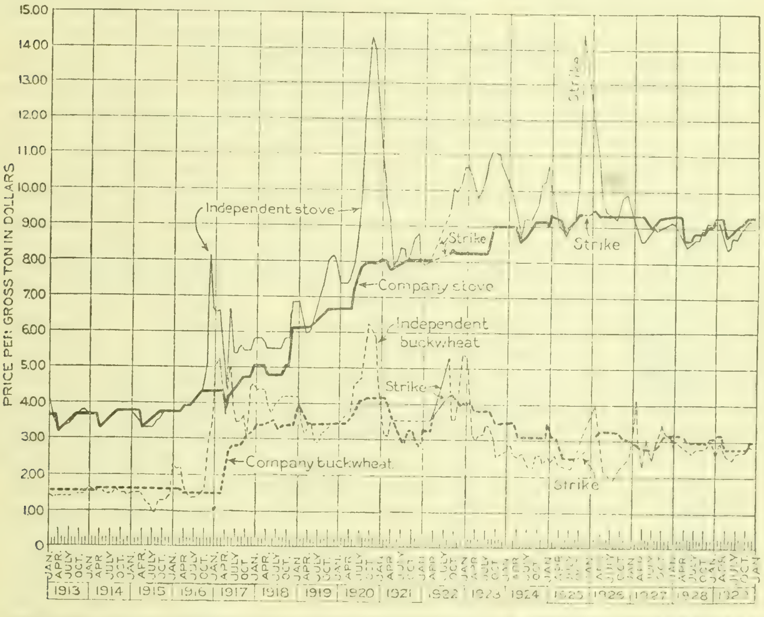

FIGURE 41.—Monthly prices of Pennsylvania anthracite f. o. b. mines, as quoted by Coal Age, 1913–1929. Prices shown are averages of the range as quoted on the New York market

The number of active anthracite operations in 1929, including breakers, washeries, and dredges, was 297, or 2 less than in the preceding year. Three more breakers were in operation than in 1928, but there was a sharp drop in the number of washeries. (See Table 22A.)

The slight decrease in the total number of operations does not in itself account for the reduction in the size of the labor force. The total number of men employed declined from 160,681 in 1928 to 151,501 in 1929, a decrease of 9,180, or 5.7 per cent. The working force in 1929 was the smallest that has been employed by the industry since 1920.

Although a smaller number of workers was employed, the men remaining in the industry enjoyed slightly steadier working time. The average number of days worked increased from 217 in 1928 to 225 in 1929. The output of 1.93 tons per man per day was the same as in 1928, but the yearly productivity per worker employed showed a gain of 3.8 per cent.

ACKNOWLEDGMENTS

Like its predecessors for more than 40 years, this report is made possible by the voluntary cooperation of those interested in the coal industry, and it is a pleasure to record the generous support of the thousands of individual producers, distributors, and consumers who have supplied information. Detailed reports on production and mine operation have been made by the producing companies and on stocks and consumption by approximately 5,000 representative consumers.

Particularly valuable has been the help afforded by the traffic managers of the coal-originating railroads, who have furnished detailed records of shipments on their lines. For the weekly and daily information on cars of coal loaded, which forms the principal basis of the current estimates of weekly production, the bureau is under obligations to M. J. Gormley, chairman of the car service division of the American Railway Association, and particularly to H. E. Ewin and G. Freeburg. Current records of shipments by waterways have been furnished by the United States Engineers.

Acknowledgment is also made of the generous help of the State mine inspectors, who have assisted in the collection of returns by furnishing information in their files, thereby increasing the accuracy of the statistics. Data have been given by W. B. Hillhouse, chief mine inspector, Birmingham, Ala.; Claude Speegle, State inspector of mines, Fort Smith, Ark.; James Dalrymple, chief inspector of coal mines, Denver, Colo.; J. S. Millhouse, director, Department of Mines and Minerals, Springfield, Ill.; A. C. Dally, chief mine inspector, Indianapolis, Ind.; W. A. Scheck, secretary to the mine inspectors, Des Moines, Iowa; James Sherwood, State mine inspector, Pittsburg, Kans.; J. F. Daniel, chief inspector of mines, Lexington, Ky.; John J. Rutledge, chief mine engineer, Maryland Bureau of Mines, Baltimore, Md.; F. G. Fenix, chief inspector, Joplin, Mo.; Edward Davies, State coal-mine inspector, Helena, Mont.; Edwin Rupp, State coal-mine inspector, Bismarck, N. Dak.; G. F. Miles, chief, division of labor statistics, Columbus, Ohio; Miller D. Hay, chief mine inspector, Oklahoma City, Okla.; W. H. Glasgow, secretary of mines, Department of Mines, Harrisburg, Pa.; A. W. Evans, chief mine inspector, Nashville, Tenn.; William R. Reese, chief mine inspector, Seattle, Wash.; R. M. Lambie, chief, Department of Mines, Charleston, W. Va.; and Lyman Fearn, chief coal-mine inspector, Rock Springs, Wyo.

The bureau finds of especial value the cooperation of the secretaries of local associations of coal operators, on account of their intimate knowledge of conditions in their several districts. Many of them have supplied current reports of production by fields. For information on 1929 the bureau is indebted to P. H. Greenlaw, secretary, St. Louis Coal Bureau, St. Louis, Mo.; Jonas Waffle, traffic manager, Indiana Bituminous Coal Operators' Association, Terre Haute, Ind.;

C. E. Reed, secretary, West Kentucky Coal Bureau, Louisville, Ky.; J. E. Johnson, secretary, Hazard Coal Operators' Exchange, Lexington, Ky.; E. R. Clayton, secretary, Harlan County Coal Operators' Association, Harlan, Ky.; C. B. Neel, secretary, Virginia Coal Operators' Association, Norton, Va.; A. W. Laing, treasurer, Winding Gulf Operators' Association, Beckley, W. Va.; S. C. Higgins, secretary-traffic manager, New River Coal Operators' Association, Mount Hope, W. Va.; T. M. Moran, secretary, Fairmont Coal Operators' Association, Fairmont, W. Va.; A. O. Wilson, statistician, Kanawha Coal Operators' Association, Charleston, W. Va.; and W. E. Maltby, manager, Washington Coal Producers' Association, Seattle, Wash. To these and many others who have supplied information cordial acknowledgment is made.

STATISTICAL SUMMARY

TABLE 1.—*Salient statistics of the coal industry in 1929*

[Figures for bituminous in net tons; anthracite in gross tons]

	Bituminous	Anthracite
Production ... tons	534, 988, 593	65, 918, 031
Value at mines	$952, 781, 000	$385, 643, 000
Average value per ton	$1. 78	$5. 85
Average spot price as quoted by Coal Age	$1. 79	(1)
Number of active mines of commercial size	6, 057	[2] 297
Stocks of commercial consumers:		
Jan. 1 ... tons	41, 800, 000	(1)
Dec. 31 ... do	40, 300, 000	(1)
Net change during year ... do	1, 500, 000	(1)
Exports ... do	17, 429, 000	3, 041, 000
Imports ... do	495, 000	435, 000
Consumption (calculated) ... do	519, 555, 000	63, 801, 000
Capacity of mines with present labor force (assuming 303.5 working days in the anthracite field and 308 working days in the bituminous field) ... tons	752, 000, 000	89, 000, 000
Average number of days worked	219	225
Average days idle:		
All causes	89	78. 5
Through strikes and lockouts	(3)	2
Other causes	89	76. 5
Average number employed:		
Miners, loaders, and shot firers	315, 678	77, 395
Haulage and track	59, 952	14, 923
Other underground	58, 369	25, 538
Surface	68, 994	33, 645
Output per man:		
Per day ... tons	4. 85	[4] 2. 16
Per year ... do	1, 064	[4] 487
Number of cutting machines	14, 731	137
Quantity cut by machines ... tons	403, 606, 717	1, 035, 634
Per cent of output cut by machines	75. 4	1. 6
Number of power shovels in strip pits	411	98
Quantity produced by stripping ... tons	20, 268, 099	1, 706, 934

[1] Data not available. For changes in producers' stocks see Table 3.

[2] Number of breakers, washeries, and dredges.

[3] Less than one-half day.

[4] Net tons.

TABLE 2.—*Summary of coal produced, value, men employed, days worked, and output per man per day, by States, 1928 and 1929*

State	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
1928														
Alabama	16,996,938	433,581	190,843		17,621,362	$39,601,000	$2.25	15,566	2,992	3,192	3,958	25,708	222	3.09
Alaska	118,440	6,400	1,260		126,100	662,000	5.25	51	10	24	48	133	224	4.23
Arizona		3,600			3,600	16,000	4.44	11			1	12	208	1.45
Arkansas	1,627,550	15,010	18,413		1,660,973	5,615,000	3.38	2,620	432	379	661	4,092	146	2.79
California, Idaho, and Oregon	18,235	4,003	1,650		23,888	70,000	2.93	43	7	16	18	84	177	1.61
Colorado	8,621,540	795.155	196,866	234,146	9,847,707	27,613,000	2.80	7,994	1,463	1,097	1,812	12,366	193	[1] 4.13
Georgia	56,487	596	259	1,048	58,390	181,000	3.10				124	124	280	1.68
Illinois	51,513,409	3,672,205	762,585		55,948,199	112,095,000	2.00	43,718	7,130	6,681	6,737	[2] 64,266	156	[2] 5.57
Indiana	15,488,382	564,930	325,268		16,378,580	29,212,000	1.78	9,967	1,859	1,735	3,245	16,806	150	6.51
Iowa	2,849,348	781,390	52,897		3,683,635	10,525,000	2.86	5,055	766	644	500	6,965	175	3.02
Kansas	2,433,549	335,739	40,436		2,809,724	6,861,000	2.44	4,153	446	261	1,131	5,991	128	3.68
Kentucky	60,454,706	884,996	454,818	65,859	61,860,379	96,722,000	1.56	37,801	7,383	8,460	8,551	62,195	212	4.69
Maryland	2,564,099	111,297	11,583		2,686,979	4,954,000	1.84	2,225	387	311	381	3,304	233	3.50
Michigan	566,587	7,637	43,118		617,342	2,631,000	4.26	818	174	127	120	1,239	187	2.67
Missouri	3,196,405	464,703	71,313		3,732,421	9,637,000	2.58	3,697	421	448	1,398	5,964	180	3.47
Montana	3,169,415	109,930	44,850		3,324,195	7,550,000	2.27	1,319	282	200	390	2,191	191	7.93
New Mexico	2,604,467	50,495	56,889		2,711,851	8,636,000	3.18	2,142	377	319	603	3,441	213	3.70
North Carolina	51,740	5,900	3,220		60,860	201,000	3.30	160	32	16	32	240	180	1.41
North Dakota	1,319,721	311,936	18,273		1,649,930	2,780,000	1.68	803	78	55	399	1,335	177	7.00
Ohio	12,786,442	2,706,600	148,183		15,641,225	26,439,000	1.69	14,151	1,937	2,317	2,966	21,371	171	4.28
Oklahoma	3,343,042	108,339	49,944		3,501,325	10,365,000	2.96	3,796	662	631	1,129	6,218	169	3.34
Pennsylvania bituminous	117,785,042	7,055,988	1,211,269	5,149,864	131,202,163	249,895,000	1.90	90,036	13,588	13,729	16,061	133,414	218	4.52
South Dakota	663	13,266			13,929	39,000	2.80	41				41	128	2.66
Tennessee	5,279,223	91,880	66,200	173,656	5,610,959	9,694,000	1.73	4,951	930	818	1,150	7,849	226	3.16
Texas	1,141,370	21,087	19,577		1,182,034	1,589,000	1.34	974	161	113	214	1,462	203	[1] 3.99
Utah	4,713,408	53,489	26,534	49,113	4,842,544	12,253,000	2.53	2,071	417	323	541	3,352	191	[1] 7.57
Virginia	11,371,792	111,853	39,130	378,158	11,900,933	20,375,000	1.71	6,293	1,766	2,445	1,808	12,312	226	4.28
Washington	2,339,921	116,897	33,730	29,353	2,519,901	8,720,000	3.46	1,951	284	367	497	3,099	220	3.70
West Virginia	128,671,064	3,020,027	537,043	724,025	132,952,159	211,480,000	1.59	64,045	16,589	15,197	15,902	111,733	223	5.35
Wyoming	6,264,930	130,695	176,058		6,571,683	17,363,000	2.64	2,912	686	432	813	4,843	214	6.34
Total bituminous	467,347,915	21,989,624	4,602,209	6,805,222	500,744,970	933,774,000	1.86	329,364	61,259	60,337	71,190	522,150	203	4.73
Pennsylvania anthracite	66,487,600	3,184,826	5,675,643		75,348,069	393,638,000	5.22	81,627	16,183	26,086	36,785	160,681	217	2.17
Grand total	533,835,515	25,174,450	10,277,852	6,805,222	576,093,039	1,327,412,000	2.30	410,991	77,442	86,423	107,975	682,831	206	4.10

1929														
Alabama	17,459,449	317,675	166,799		17,943,923	37,309,000	2.08	15,287	2,961	3,244	3,716	25,208	231	3.08
Alaska	94,600	5,010	1,000		100,610	528,000	5.25	50	10	24	68	152	174	3.81
Arizona		10,060	72		10,132	44,000	4.34	33	2	2	2	39	137	1.90
Arkansas	1,659,573	26,020	9,515		1,695,108	5,624,000	3.32	2,906	412	316	665	4,299	146	2.70
California, Idaho, Nevada, and Oregon	7,840	2,222	260		10,322	37,000	3.58	23	3	6	10	42	113	2.17
Colorado	8,664,817	824,049	183,746	248,129	9,920,741	26,254,000	2.65	7,981	1,227	1,226	1,623	12,057	187	[1] 4.40
Georgia	43,921	458	257		44,636	136,000	3.05				102	102	260	1.68
Illinois	55,712,372	3,991,337	953,932		60,657,641	113,453,000	1.87	36,781	6,336	6,764	6,844	56,725	177	6.06
Indiana	17,387,599	630,524	326,235		18,344,358	29,880,000	1.63	8,852	1,615	1,561	3,222	15,250	172	7.00
Iowa	3,383,801	800,029	57,239		4,241,069	11,948,000	2.82	5,408	655	693	539	7,295	195	2.98
Kansas	2,635,600	251,807	88,564		2,975,971	6,697,000	2.25	3,638	333	218	950	5,139	160	3.63
Kentucky	59,125,101	860,161	477,338		60,462,600	93,283,000	1.54	36,090	7,586	7,203	7,770	58,649	222	4.64
Maryland	2,518,092	119,829	11,193		2,649,114	4,640,000	1.75	2,170	395	362	362	3,289	246	3.28
Michigan	744,517	10,725	49,627		804,869	2,904,000	3.61	899	164	154	119	1,336	217	2.77
Missouri	3,467,666	498,217	64,428		4,030,311	9,778,000	2.43	3,433	402	447	1,336	5,618	185	3.87
Montana	3,221,905	137,790	47,831		3,407,526	7,561,000	2.22	1,326	303	202	452	2,283	189	7.90
New Mexico	2,514,971	51,228	56,570		2,622,769	8,314,000	3.17	2,107	350	294	482	3,233	214	3.79
North Carolina	46,280	3,200	2,700		52,180	177,000	3.39	120	10	10	20	160	260	1.25
North Dakota	1,442,988	380,640	38,502		1,862,130	3,157,000	1.70	772	92	74	483	1,421	192	6.84
Ohio	20,840,851	2,708,715	139,911		23,689,477	35,733,000	1.51	17,689	2,452	2,093	3,165	25,399	201	4.64
Oklahoma	3,601,911	125,830	46,339		3,774,080	11,481,000	3.04	3,944	703	616	1,058	6,321	178	3.36
Pennsylvania bituminous	127,064,532	8,048,253	1,095,730	7,307,726	143,516,241	258,607,000	1.80	87,705	13,777	14,563	15,729	131,774	230	4.73
South Dakota	200	12,654			12,854	38,000	2.96	32				32	127	3.17
Tennessee	5,101,399	63,032	55,001	186,032	5,405,464	9,122,000	1.69	4,880	909	755	1,075	7,619	228	3.11
Texas	1,075,365	11,066	14,237		1,100,668	1,600,000	1.45	885	128	105	195	1,313	212	3.95
Utah	5,072,527	47,955	16,678	23,361	5,160,521	12,725,000	2.47	2,076	467	323	592	3,458	211	[1] 7.09
Virginia	12,119,712	92,192	41,244	495,158	12,748,306	20,942,000	1.64	6,509	1,714	1,982	1,848	12,053	249	4.24
Washington	2,299,619	153,472	33,342	34,894	2,521,327	8,647,000	3.43	1,810	333	346	457	2,946	227	3.77
West Virginia	134,241,631	2,946,830	497,087	833,307	138,518,855	215,110,000	1.55	59,324	15,984	14,278	15,356	104,942	247	5.34
Wyoming	6,385,615	131,578	187,597		6,704,790	17,052,000	2.54	2,948	629	508	754	4,839	230	6.02
Total bituminous	497,934,454	23,262,558	4,662,974	9,128,607	534,988,593	952,781,000	1.78	315,678	59,952	58,369	68,994	502,993	219	4.85
Pennsylvania anthracite	65,294,579	3,233,023	5,300,593		73,828,195	385,643,000	5.22	77,395	14,923	25,538	33,645	151,501	225	2.17
Grand total	563,229,033	26,495,581	9,963,567	9,128,607	608,816,788	1,338,424,000	2.20	393,073	74,875	83,907	102,639	654,494	221	4.21

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[1] Probably too high because of practice, common in some districts, of men going into mines to shoot coal and load mine cars on days when tipples or mines, as a whole, are not in operation.

[2] The figure of 5.57 tons per man per day for Illinois is not comparable with earlier years, although computed in exactly the same way. It is obtained by dividing the tonnage produced by the total number of man-days worked, the latter being calculated for each mine by multiplying the average number of men employed by the number of days that the mine worked. This method of calculation is the best one feasible in the light of the records kept by the majority of American coal operators, and the results are generally comparable from year to year. In Illinois during 1928, however, some operators installing mechanical loading for the first time pursued the practice of dividing up the work among the men already on their pay rolls in order to avoid discharging men. For this reason the number of men reported as employed in 1928 (64,266) is considerably in excess of the number actually at work on any one day. Were it possible to allow for this fact, the output per man per day would appear materially higher than 5.57 tons. Even so, it shows a notable increase over the 5.36 tons reported in 1927.

TABLE 3.—*Production, imports, exports, and consumption of anthracite and bituminous coal, 1917–1929, in net tons*

Calendar year	Production	Imports	Exports to—		Net changes in stocks [1]	Consumption in the United States [2]
			Canada and Mexico	All other countries		
Anthracite:						
1917	99, 612, 000	13, 000	5, 917, 000	90, 000	−450, 000	94, 068, 000
1918	98, 826, 000	37, 000	4, 910, 000	58, 000	+1, 120, 000	92, 775, 000
1919	88, 092, 000	83, 000	4, 871, 000	106, 000	+1, 680, 000	81, 518, 000
1920	89, 598, 000	32, 000	4, 987, 000	417, 000	−1, 560, 000	85, 786, 000
1921	90, 473, 000	9, 000	4, 569, 000	108, 000	+3, 855, 000	81, 950, 000
1922	54, 683, 000	234, 000	2, 579, 000	70, 000	−4, 530, 000	56, 798, 000
1923	93, 339, 000	300, 000	4, 993, 000	97, 000	+1, 635, 000	86, 914, 000
1924	87, 927, 000	118, 000	3, 932, 000	86, 000	+3, 310, 000	80, 717, 000
1925	61, 817, 000	383, 000	3, 098, 000	81, 000	−5, 040, 000	64, 061, 000
1926	84, 437, 000	814, 000	3, 947, 000	83, 000	+4, 000, 000	77, 221, 000
1927	80, 096, 000	119, 000	3, 248, 000	78, 000	+2, 218, 000	74, 671, 000
1928	75, 348, 000	385, 000	3, 298, 000	38, 000	−1, 254, 000	73, 651, 000
1929	73, 828, 000	487, 000	3, 378, 000	28, 000	−548, 000	71, 457, 000
Bituminous:						
1917	551, 791, 000	1, 448, 000	18, 324, 000	5, 506, 000		529, 409, 000
1918	579, 386, 000	1, 457, 000	18, 316, 000	4, 034, 000	+27, 900, 000	530, 593, 000
1919	465, 860, 000	1, 012, 000	12, 064, 000	8, 050, 000	−34, 900, 000	481, 658, 000
1920	568, 667, 000	1, 245, 000	16, 458, 000	22, 059, 000	+22, 800, 000	508, 595, 000
1921	415, 922, 000	1, 258, 000	13, 590, 000	9, 541, 000	+2, 200, 000	391, 849, 000
1922	422, 268, 000	5, 060, 000	10, 938, 000	1, 475, 000	−12, 000, 000	426, 915, 000
1923	564, 565, 000	1, 882, 000	16, 960, 000	4, 494, 000	+26, 000, 000	518, 993, 000
1924	483, 687, 000	417, 000	12, 746, 000	4, 354, 000	−17, 000, 000	484, 004, 000
1925	520, 053, 000	602, 000	13, 547, 000	3, 915, 000	+4, 000, 000	499, 193, 000
1926	573, 367, 000	486, 000	13, 762, 000	21, 510, 000	+6, 000, 000	532, 581, 000
1927	517, 763, 000	550, 000	14, 724, 000	3, 288, 000	+500, 000	499, 801, 000
1928	500, 745, 000	547, 000	14, 050, 000	2, 114, 000	−13, 700, 000	498, 828, 000
1929	534, 989, 000	495, 000	14, 727, 000	2, 702, 000	−1, 500, 000	519, 555, 000

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[1] Anthracite figures are producers' stocks; bituminous, consumers' stocks. Plus sign denotes coal produced but added to stocks and not consumed; minus sign denotes coal consumed that was withdrawn from stocks carried over from preceding year. Anthracite data from Federal Trade Commission cost reports (Coal, No. 2, p. 27) and hearings before Frelinghuysen coal committee, S. Res. 126, 66th Cong., 1st sess. (pt. 1, p. 308). Anthracite figures for 1918 represent the coal year, since then calendar years, and are in part estimates. Bituminous data from reports on consumers' stocks of bituminous coal, issued by United States Bureau of Mines, and article in Coal Age, Aug. 26, 1920, p. 429, by C. E. Lesher, formerly coal statistician, U. S. Geological Survey, and director of statistical division, United States Fuel Administration.

[2] Production tonnage, plus imports and minus exports, plus or minus the decrease or increase, respectively, of the net change in coal stocks.

TABLE 4.—*Salient statistics of the bituminous-coal industry in 1913, 1923, and 1926–1929*

	1913	1923	1926	1927	1928	1929
Production:						
Loaded at mines for shipment ---- net tons	403, 434, 246	505, 859, 295	526, 285, 997	480, 223, 441	467, 347, 915	497, 934, 454
Sold to local trade and used by employees ---- do	13, 871, 828	22, 081, 040	23, 601, 587	21, 889, 884	21, 989, 624	23, 262, 558
Used at mines for power and heat ---- do	11, 670, 903	8, 765, 011	5, 727, 852	4, 930, 394	4, 602, 209	4, 662, 974
Made into coke at mines ---- do	49, 458, 320	27, 859, 316	17, 751, 549	10, 719, 633	6, 805, 222	9, 128, 607
Total ---- do	478, 435, 297	564, 564, 662	573, 366, 985	517, 763, 352	500, 744, 970	534, 988, 593
Value at mines (total)	$565, 235, 000	$1, 514, 621, 000	$1, 183, 412, 000	$1, 029, 657, 000	$933, 774, 000	$952, 781, 000
Average sales realization per ton	$1. 18	$2. 68	$2. 06	$1. 99	$1. 86	$1. 78
Average spot price, as quoted by Coal Age	$1. 23	$2. 77	$2. 21	$1. 99	$1. 80	$1. 79
Number of active mines of commercial size:						
Class 1A (producing 500,000 tons or more)	694	748	174	132	152	209
Class 1B (producing 200,000 to 500,000 tons)			649	647	621	618
Class 2 (producing 100,000 to 200,000 tons)	837	935	845	818	687	660
Class 3 (producing 50,000 to 100,000 tons)	959	1, 176	867	879	725	668
Class 4 (producing 10,000 to 50,000 tons)	1, 558	2, 742	1, 912	1, 831	1, 513	1, 361
Class 5 (producing less than 10,000 tons)	1, 728	3, 730	2, 730	2, 704	2, 752	2, 541
Total	5, 776	9, 331	7, 177	7, 011	6, 450	6, 057
Per cent of output from mines in classes 1A, 1B, and 2	75. 4	70. 4	79. 1	77. 1	80. 1	83. 1
Exports to Canada ---- net tons	15, 115, 733	16, 854, 257	13, 633, 513	14, 594, 297	13, 958, 961	14, 645, 001
Exports overseas and all other ---- do	5, 029, 435	4, 599, 322	21, 638, 424	3, 417, 447	2, 205, 524	2, 784, 297
Imports ---- do	1, 583, 520	1, 882, 306	485, 666	549, 843	546, 526	495, 219
Consumption (calculated) ---- do	459, 874, 000	518, 993, 000	532, 581, 000	499, 801, 000	498, 828, 000	519, 555, 000
Capacity of mines with existing labor force, assuming 308 working days a year ---- net tons	635, 000, 000	970, 000, 000	821, 000, 000	835, 000, 000	760, 000, 000	752, 000, 000
Average number of days worked	232	179	215	191	203	219
Average number of days idle	76	129	93	117	105	89
Average number of men employed at mines in operation:						
Miners, loaders, and shot firers	[1] 494, 238	422, 040	370, 292	372, 565	329, 364	315, 678
Other underground		178, 265	140, 532	139, 541	121, 596	118, 321
Surface	[1] 77, 644	104, 488	82, 823	81, 812	71, 190	68, 994
Total	571, 882	704, 793	593, 647	593, 918	522, 150	502, 993
Output per man per day ---- net tons	3. 61	4. 47	4. 50	4. 55	4. 73	4. 85
Output per man per year ---- do	837	801	966	872	959	1, 064
Per cent of output cut by machine	50. 7	66. 9	71. 7	72. 2	73. 8	75. 4
Number of power shovels in strip pits	[2] 48	442	410	455	415	411
Quantity produced by stripping ---- net tons	[2] 1, 280, 946	11, 844, 347	16, 922, 695	18, 378, 166	19, 788, 577	20, 268, 099

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[1] Estimate.

[2] Figures are for 1914, the year of earliest record.

METHODS OF COLLECTING THE STATISTICS

VOLUNTARY COOPERATION

The principal statistics for each State for 1928 and 1929 are given in Table 2. These statistics are obtained from the producers' written reports, most of them signed by officers of the companies that furnish the figures. The reports are collected by correspondence, which is supplemented by visits of field agents if correspondence has failed. The Bureau of Mines has no power to compel the filing of reports.

Under this system accurate results can be obtained only by the generous cooperation of the producers in furnishing returns voluntarily. The operators generally respond cordially to the bureau's questionnaires, with which they have become familiar through nearly 50 years of contact and cooperation, so that a very large percentage of the returns is obtained by mail, leaving relatively few reports to be obtained by personal visits.

COMPLETENESS OF THE RETURNS

Commercial mines and wagon mines.—A complete count of the thousands of wagon mines and country coal banks from which bituminous coal is dug in the United States could be made only by sending agents up every creek and along every hillside in the coal-bearing regions. The cost of such a count would prohibit it, and in practice a limit must be set to the size of the mines to be considered. The Federal Census Bureau set this limit at mines producing about 1,000 tons a year for the decennial census of mines and quarries, taken in 1920. Many of the States that publish statistics set the limit higher. The Pennsylvania Department of Mines, for example, covers only enterprises employing as many as 10 men.

The Bureau of Mines desires to ascertain the total output of coal from all sources, large or small, in order to find the rate at which the country's resources are being drawn upon. In practice, however, it has been found advisable to employ different methods for the commercial mines, on the one hand, and the wagon mines, on the other.

The line between commercial mines and small workings, however, is difficult to draw. Mere size of output is not a criterion, for some wagon mines produce rather large quantities of coal. Absence of a railroad switch is not a criterion, for this would exclude from the commercial class some large mines that ship by river or truck or that deliver their product to associated industries at the mouth of the mine.

In practice, the Bureau of Mines has found a safer criterion to be size in conjunction with steady operation. All mines that produce 10,000 tons or more a year are classed by the bureau as commercial mines; but this class also includes much smaller mines, some of which have an annual output of hardly 1,000 tons, but produce year after year and show a fairly continuous existence.

These smaller properties sometimes ship by rail but oftener serve a local market by wagon or truck or supply a local manufacturing plant near the tipple. There are hundreds of such small operations that continue to contribute to the supply of coal year after year, and the bureau endeavors to include them in its lists of commercial producers. A mine may be shifted from the list of commercial mines to the list of wagon mines, or vice versa, as the course of the work at the mine may make such a shift advisable.

Method of obtaining data on commercial mines.—For the commercial mines statistics can be obtained largely by correspondence. To the mailing list new names are constantly being added from the trade journals, from the records of State mine inspectors, from reports of field agents, and from reports by the producers themselves. At intervals the list is checked against lists kept by associations of operators or State officials and lists of shippers kept by railroad car distributors.

Schedules of inquiry are mailed by the Bureau of Mines to all producing companies listed, and no company is dropped from the list until it has been definitely accounted for. To follow up companies from which no reply is received by correspondence, cooperative arrangements have been made with State geologists and coal-mine inspectors, secretaries of operator's associations, and other local agents, who make inquiry in person and report to Washington. In the Western States the work of following up the returns is aided by the branch offices maintained by the Bureau of Mines at Joplin, Denver, Salt Lake City, and San Francisco. Areas to which no permanent local representative of the bureau has been assigned can be covered only by sending out field agents from Washington.

Some of the mines are operated so intermittently that the owners can not be found at the end of the year, and recourse must be had to railroads to find the number of tons of coal shipped by these mines, from which estimates can be made of the number of men employed and the value of the product. Such estimates are made in order to round out totals, but only when the evidence shows that a mine was in operation during the year and when all other means of getting the exact figures have failed. Wherever in this report the inclusion of estimates introduces the probability of significant error, that fact is indicated.

Method of obtaining data on wagon mines.—The method just described has yielded satisfactory figures for the operation of mines on the list of commercial producers. To handle the sporadic wagon mines, "fly-by-nights," and "snowbirds" that appear, mushroom-like, at times of shortage and high prices, requires a different method. All these workings are referred to by the bureau as wagon mines, the term in common usage that most nearly describes them. Where these wagon mines are within reach of a railroad and are therefore able to demand railroad cars for shipment of their product, they may have a material influence on the car supply, on the spot price, on the rate of wages, and on the prevailing quality of coal, an influence out of all proportion to the actual tonnages they ship. In 1920, for example, there were more than 4,000 such wagon mines in operation, all demanding railroad cars, and they shipped by rail about 4,500,000 tons of bituminous coal. They are chiefly important in the Appalachians, where coal outcrops abundantly along many of the railroads and surfaced highways. Under such conditions coal can be dug with almost no capital investment. The labor cost at wagon mines is high. Such workings can compete in shipping by rail only in periods of high prices but can open or close without thought of fixed charges, depreciation, and maintenance; their only consideration is the price of coal on the spot market.

When coal prices are high the wagon mines are important enough to be included in the statistics, but how to obtain complete information about them is a problem. After experimenting with various methods the bureau has found that the only feasible plan is to ask each railroad for a list of the wagon mines on its lines that shipped coal during the year and for the number of cars shipped by each. Such information was generously furnished by the railroads in 1920, 1922, and 1923 and gave virtually complete information as to the number, location, and output of the wagon mines that shipped by rail in those years.

On the other hand, when the price is low, wagon mines may close as suddenly as they open, and they disappear as a factor in the railborne trade; therefore, in 1921, and from 1924 to 1929, no attempt was made to get information on the output of these mines. Statistics for these years relate to the commercial mines exclusively. It is not to be inferred, however, that the figures given are incomplete. A complete count of all the wagon mines shipping by rail would have added only a few thousand tons to the totals in this report.

Omission of country coal banks.—The methods outlined above are believed to yield virtually complete returns for all mines, big and little, that ship by rail or water and for all those of commercial size that serve a purely local market. The data herein do not cover the tiny workings that produce less than 1,000 tons a year and are situated at points remote from a railroad—workings that can best be described as country coal banks. Little openings of this kind, where one or two men dig a few hundred bushels for sale in the neighborhood or farmers come with their wagons and trucks to dig their own fuel, are common in regions where coal outcrops. Although their number runs into the thousands, their combined output is so small as to be negligible; their product does not involve the use of railroad cars and does not compete with the output of commercial mines. When in the past the attempt was made to obtain data on these coal banks regularly, the maximum total output reported for them was about 1,000,000 tons a year, a quantity too small to justify the cost of collecting the information.

UNITS OF MEASUREMENT

The standard unit of measurement adopted for this report is the net or short ton of 2,000 pounds, but as Pennsylvania anthracite is mined and sold by the gross or long ton of 2,240 pounds that unit is used in the section of the report dealing with anthracite. Unless otherwise expressly stated, the word "ton" as here used means the net ton of 2,000 pounds, to which all other figures, however reported, have been converted.

There is a steadily growing sentiment in favor of the general use of the net ton of 2,000 pounds as the standard unit of the coal trade, particularly for bituminous coal in the Eastern States, where both gross and net tons are now used. The use of both units is, of course, undesirable, but as some State and municipal laws require the use of the gross ton and as freight rates throughout a part of the Eastern States are now fixed accordingly it is difficult to make an immediate change to a standard unit. In reports on foreign trade and shipping rates quantities are expressed in either gross or metric tons, and here, too, the use of more than one unit is undesirable. The general use of the net ton in the United States, even in the anthracite region, is here recommended.

ANTHRACITE, BITUMINOUS COAL, AND LIGNITE

Two industries.—In the statistical reports of the Bureau of Mines the anthracite industry of Pennsylvania and the bituminous-coal industry are listed separately. Both produce coal, and between them there is a certain degree of competition, especially in the sale of the anthracite steam sizes; but the differences in corporate organization, in railroad relations, in geographic position, in natural conditions of mining, in marketing practices, in methods of preparing the coal for the market, and in the nature of the demand are so pronounced that they require separate treatment.

Pennsylvania anthracite industry.—The Pennsylvania anthracite industry, as understood in the trade and as used in this report, is confined to a narrow area of 480 square miles in eastern Pennsylvania. It includes the familiar Lehigh, Schuylkill, and Wyoming regions and also the little outlying Bernice Basin in Sullivan County. In this sharply restricted region are concentrated mines that employed 152,000 men and produced 73,828,000 net tons of coal in 1929.

Hard coal mined outside of Pennsylvania.—The statistics of the bituminous-coal industry published in this and in preceding reports include anthracite and semianthracite mined outside of Pennsylvania. Such coals are commercially produced in the Crested Butte field of Colorado, in the Los Cerrillos area of New Mexico, in the Spadra and Russellville districts of Arkansas, and in that portion of the Valley coal fields of Virginia lying in Montgomery and Pulaski Counties. The operations in these areas are in no way connected with the close-knit anthracite industry of Pennsylvania. They are affiliated rather with the bituminous industry in their respective States and have therefore been included with the bituminous operations in the statistical record.

However, in view of the growing tonnage of hard coal mined outside of Pennsylvania and the present interest in all fuels available for househeating—to which this coal is admirably adapted—special attention is given to statistics covering the hard-coal output of Arkansas, Colorado, New Mexico, and Virginia on pages 818 to 823 of this report. The total production increased from 363,324 tons in 1913 to 842,313 tons in 1929. (See fig. 56.)

Lignite.—The statistics of the bituminous-coal industry published in this report include lignite. In the classification of coals adopted by the United States Geological Survey the "black lignites" mined in the far West are termed "subbituminous coals." True lignite, although occurring in enormous amounts in the northern Great Plains and Gulf coast geological provinces, is as yet little mined in the United States. The production in 1929 was about 2,930,000 tons, of which 1,862,000 was mined in North Dakota, 13,000 in South Dakota, 64,000 in eastern Montana, and 991,000 in the lignite area of Texas. Although the producers of this coal have certain problems in common they do not form a separate national interest, as does the brown-coal industry of Germany. At present the statistics on lignite can best be combined with those for bituminous coal.

GROWTH OF INDUSTRY

HISTORICAL SUMMARY

TABLE 5.—*Growth of the bituminous coal-mining industry, 1890–1929*

Year	Production (millions of net tons)	Value (millions of dollars)	Men employed (thousands)	Calculated capacity (millions of net tons)		Average number of days worked	Average number of days lost on account of—			Value per ton	Net tons per man		Per cent cut by machine	Mined by stripping (millions of net tons)[1]
				At 308 days	At 280 days		Strikes	Other causes	Total lost		Per day	Per year		
1890	111	110	192	152	137	226	(2)	(2)	82	$0.99	2.56	579	(2)	(2)
1891	118	117	206	163	148	223	(2)	(2)	85	.99	2.57	573	5.3	(2)
1892	127	125	213	178	162	219	(2)	(2)	89	.99	2.72	596	(2)	(2)
1893	128	123	230	194	174	204	(2)	(2)	104	.96	2.73	557	(2)	(2)
1894	119	108	245	214	196	171	(2)	(2)	137	.91	2.84	486	(2)	(2)
1895	135	116	240	215	196	194	(2)	(2)	114	.86	2.90	563	(2)	(2)
1896	138	115	244	221	202	192	(2)	(2)	116	.83	2.94	564	11.9	(2)
1897	148	120	248	232	213	196	(2)	(2)	112	.81	3.04	596	15.3	(2)
1898	167	133	256	243	221	211	(2)	(2)	97	.80	3.09	651	19.5	(2)
1899	193	168	271	254	230	234	8	66	74	.87	3.05	713	22.7	(2)
1900	212	221	304	279	255	234	5	69	74	1.04	2.98	697	24.9	(2)
1901	226	236	340	309	281	225	2	81	83	1.05	2.94	664	25.6	(2)
1902	260	291	370	348	316	230	7	71	78	1.12	3.06	703	26.8	(2)
1903	283	352	416	387	350	225	3	80	83	1.24	3.02	680	27.6	(2)
1904	279	306	438	425	386	202	8	98	106	1.10	3.15	637	28.2	(2)
1905	315	335	461	460	417	211	2	95	97	1.06	3.24	684	32.8	(2)
1906	343	381	478	496	451	213	28	67	95	1.11	3.36	717	34.7	(2)
1907	395	451	513	520	473	234	1	73	74	1.14	3.29	769	35.1	(2)
1908	333	374	516	531	482	193	11	104	115	1.12	3.34	644	37.0	(2)
1909	380	405	543	560	510	209	1	98	99	1.07	(2)	(2)	37.5	(2)
1910	417	469	556	592	538	217	35	56	91	1.12	3.46	751	41.7	(2)
1911	406	451	550	593	538	211	2	95	97	1.11	3.50	738	43.9	(2)
1912	450	518	549	622	566	223	10	75	85	1.15	3.68	820	46.8	(2)
1913	478	565	572	635	577	232	5	71	76	1.18	3.61	837	50.7	(2)
1914	423	493	584	668	608	195	19	94	113	1.17	3.71	724	51.7	1.3
1915	443	502	557	672	610	203	4	101	105	1,13	3.91	794	55.0	2.8
1916	503	665	561	673	613	230	4	74	78	1.32	3.90	896	56.5	3.9
1917	552	1,249	603	699	636	243	4	61	65	2.26	3.77	915	55.5	5.8
1918	579	1,492	615	717	650	249	1	58	59	2.58	3.78	942	55.9	8.3
1919	466	1,161	622	736	669	195	25	88	113	2.49	3.84	749	59.2	5.6
1920	569	2,130	640	796	725	220	6	82	88	3.75	4.00	881	59.8	8.9
1921	416	1,200	664	860	781	149	3	156	159	2.89	4.20	627	65.6	4.7
1922	422	1,275	688	916	832	142	78	88	166	3.02	4.28	609	63.2	9.9
1923	565	1,515	705	970	885	179	2	127	129	2.68	4.47	801	66.9	11.8
1924	484	1,063	620	871	792	171	7	130	137	2.20	4.56	781	69.5	13.6
1925	520	1,060	588	822	748	195	2	111	113	2.04	4.52	884	70.6	16.9
1926	573	1,183	594	821	747	215	1	92	93	2.06	4.50	966	71.7	16.9
1927	518	1,030	594	835	759	191	45	72	117	1.99	4.55	872	72.2	18.4
1928	501	934	522	760	691	203	8	97	105	1.86	4.73	959	73.8	19.8
1929	535	953	503	752	679	219	(3)	89	89	1.78	4.85	1,064	75.4	20.3

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[1] For the years 1914–1923, inclusive, the figures of quantity mined by stripping do not include a small amount which was stripped by some other means than steam shovels, so for these years the tonnages are slightly less than the total recovered by stripping shown in some of the tables in earlier reports of this series.

[2] No data.

[3] Less than one-half day.

TABLE 6.—*Growth of the anthracite-mining industry, 1890–1929*

Year	Production (millions of gross tons)	Value (millions of dollars)	Employees (thousands)	Calculated capacity at 304 days (millions of gross tons)	Average number of days worked	Net tons per man		Washery and dredge shipments (millions of gross tons)	Per cent of shipments that were domestic sizes (excluding pea) [1]	Per cent of total shipments that came from [2]—		
						Per day	Per year			Lehigh region	Schuylkill region	Wyoming region
1890	41	66	126	63	200	1.85	369	(3)	76.9	17.3	29.7	53.0
1891	45	74	126	68	203	1.98	401	0.1	75.7	15.8	31.5	52.7
1892	47	82	129	72	198	2.06	407	.1	76.0	15.4	30.1	54.5
1893	48	86	133	74	197	2.06	406	.2	74.9	16.0	28.7	55.3
1894	46	78	132	74	190	2.08	395	.6	73.7	16.2	29.1	54.7
1895	52	82	143	80	196	2.07	406	1.1	69.9	15.7	30.7	53.6
1896	49	82	149	85	174	2.10	365	.9	70.3	15.0	30.4	54.6
1897	47	79	150	95	150	2.34	351	1.0	68.5	15.0	29.3	55.7
1898	48	75	146	95	152	2.41	367	1.1	67.3	14.9	28.8	56.3
1899	54	88	140	95	173	2.50	433	1.4	66.1	14.4	29.8	55.8
1900	51	86	144	94	166	2.40	398	2.1	64.7	15.3	30.0	54.7
1901	60	113	145	93	196	2.37	464	2.6	64.2	13.5	29.9	56.6
1902	37	76	148	97	116	2.40	279	2.0	61.0	11.1	27.2	61.7
1903	67	152	150	98	206	2.41	496	3.6	63.6	12.1	27.7	60.2
1904	65	139	156	99	200	2.35	469	2.8	62.0	12.4	28.5	59.1
1905	69	142	165	98	215	2.18	470	2.6	60.9	12.8	28.8	58.4
1906	64	132	162	99	195	2.25	439	3.8	59.1	12.6	28.8	58.6
1907	76	164	167	106	220	2.33	512	4.3	58.6	12.4	30.0	57.6
1908	74	158	174	113	200	2.39	478	3.6	59.3	12.0	27.9	60.1
1909	72	149	(4)	107	205	(1)	(4)	3.7	58.3	12.2	27.2	60.6
1910	75	161	169	100	229	2.17	498	3.3	58.6	13.3	27.5	59.2
1911	81	175	173	100	246	2.13	524	3.2	59.4	13.9	27.4	58.7
1912	75	178	174	99	231	2.10	485	3.2	60.8	13.6	28.2	58.2
1913	82	195	176	97	257	2.02	520	2.1	61.7	14.4	27.4	58.2
1914	81	188	180	101	245	2.06	505	1.7	61.4	14.7	26.3	59.0
1915	79	185	177	105	230	2.19	504	2.5	60.1	14.9	26.5	58.6
1916	78	202	160	94	253	2.16	548	3.1	60.5	14.1	29.3	56.6
1917	[5] 89	284	154	95	285	[5] 2.27	[5] 646	5.4	61.0	14.9	28.6	56.5
1918	[5] 88	336	147	92	293	[5] 2.29	[5] 672	6.6	60.1	15.1	28.9	56.0
1919	79	365	155	90	266	2.14	570	3.3	64.2	15.5	28.5	56.0
1920	[5] 80	434	145	90	271	[5] 2.28	[5] 618	5.0	63.1	14.6	30.4	55.0
1921	81	452	160	91	271	2.09	567	1.6	66.5	13.5	28.9	57.6
1922	[5] 49	274	157	98	151	[5] 2.31	[5] 349	3.2	62.9	13.9	31.8	54.3
1923	83	507	158	95	268	2.21	592	4.1	63.7	13.9	30.4	55.7
1924	79	477	160	87	274	2.00	550	1.4	65.3	13.5	28.5	58.0
1925	55	328	160	92	182	2.12	386	1.4	66.4	14.0	29.1	56.9
1926	75	474	165	94	244	2.09	511	1.4	66.7	14.0	28.3	57.7
1927	72	421	165	96	225	2.15	485	1.8	63.3	14.0	30.0	56.0
1928	67	394	161	94	217	2.17	469	1.7	61.8	13.4	30.5	56.1
1929	66	386	152	89	225	2.16	487	1.0	62.6	14.1	28.2	57.7

[1] Excludes Sullivan County and dredge coal.
[2] Includes dredge shipments, 1914–1929.
[3] Less than one-tenth million tons.
[4] No data.
[5] Years of heavy washery output

RELATIVE RATE OF GROWTH OF COAL AND OTHER SOURCES OF POWER

Bituminous coal remains the principal source of the energy supply of the United States. Coal production in 1929, although higher than in 1927 and 1928, was below the war-time maximum, while the production of oil, natural gas, and water power has increased enormously since the war. (See fig. 42.) Tables 7 to 9 bring out the differences in relative growth of the principal sources of energy.

To compare the several sources of energy it is necessary to reduce them to a common denominator, as is done in Table 7, which shows the energy equivalent in British thermal units of each of the fuels.

Water power is represented by the equivalent of the fuel necessary to perform the same work. The total of the energy from all sources is given in the last column of the table. For 1929 it amounts to 26,534 trillion British thermal units, which is the greatest in the history of the country. Thus, while the consumption of coal has not advanced since the war, the total consumption of energy has increased.

The fact should be noted that the figures for "domestic oil," as in earlier issues of these tables, represent the entire production of crude petroleum. Thus they not only include energy used in the form of fuel oil under boilers and therefore competing more or less directly with coal but also that used as gasoline, kerosene, and other refined products. Even these refined products involve a measure of indirect competition with coal, for the energy market of the country is becoming more and more fluid and competitive, and a demand that can not be met by one source of supply tends to fall back on the others. The purpose of these tables is to measure the total demand for energy.

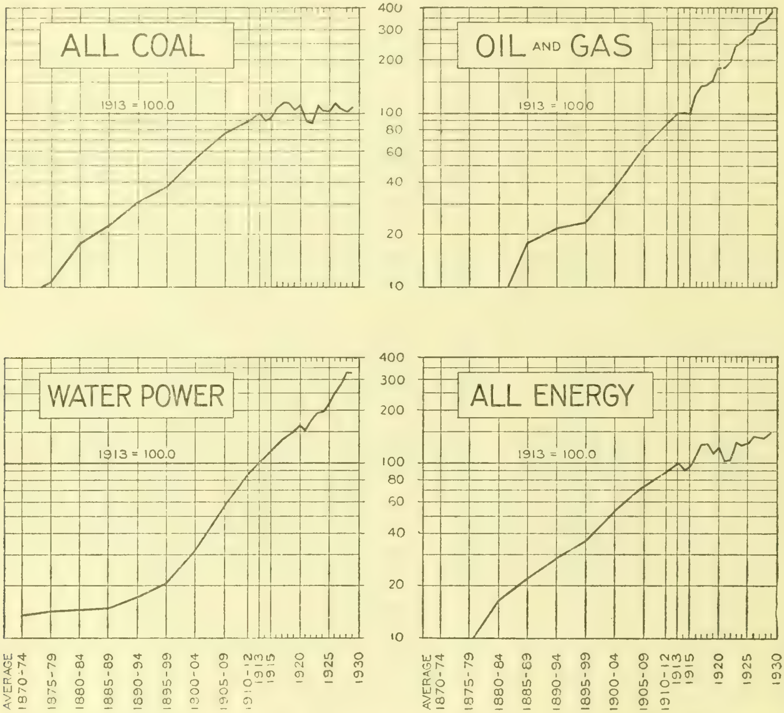

FIGURE 42.—Relative rate of growth of annual supply of coal, oil and gas, and water power in the United States, 1870-1929

TABLE 7.—*Annual supply of energy from mineral fuels and water power in the United States, 1819–1929*

[Figures represent trillions of British thermal units and because of rounding do not always add across exactly. In calculating thermal equivalents, the gross British thermal unit values are used. Water power is represented by British thermal units of coal necessary to produce the same amount of power. Figures represent production except those for oil imports and take no account of changes of stock]

Year	Anthracite	Bituminous coal	Total coal	Domestic oil (total crude, including that refined)	Natural gas (total production)	Imported oil (total crude, including that refined)	Total oil and gas	Total mineral fuels	Water power	Grand total, including water power
1819	(1)	--------	(1)	--------	--------	--------	--------	(1)	(2)	(2)
1829	4	3	6	--------	--------	--------	--------	6	(2)	(2)
1839	27	41	68	--------	--------	--------	--------	68	(2)	(2)
1849	109	64	173	--------	--------	--------	--------	173	(2)	(2)
1859	262	158	419	(1)	--------	--------	--------	419	(2)	(2)
1869	464	415	879	25	--------	--------	25	904	(2)	(2)
1879	822	993	1,815	119	(1)	--------	119	1,934	(2)	(2)
1889	1,239	2,507	3,746	211	[3] 268	--------	479	4,225	91	4,316
1899	1,643	5,065	6,708	342	[3] 240	--------	582	7,291	135	7,426
1909	2,205	9,949	12,155	1,099	517	(4)	1,616	13,771	411	14,182
1913	2,490	12,535	15,025	1,491	626	102	2,219	17,243	588	17,831
1918	2,688	15,180	17,868	2,136	775	226	3,137	21,005	837	21,842
1919	2,396	12,206	14,602	2,270	802	317	3,389	17,991	892	18,883
1920	2,437	14,899	17,336	2,658	858	637	4,153	21,489	971	22,460
1921	2,461	10,897	13,358	2,833	712	752	4,297	17,655	908	18,563
1922	1,487	11,063	12,551	3,345	820	764	4,929	17,480	1,024	18,504
1923	2,539	14,791	17,330	4,394	1,082	492	5,968	23,298	1,136	24,434
1924	2,392	12,672	15,064	4,284	1,227	467	5,978	21,042	1,167	22,209
1925	1,681	13,625	15,306	4,582	1,278	371	6,231	21,537	1,290	22,827
1926	2,297	15,022	17,319	4,625	1,411	362	6,398	23,717	1,492	25,209
1927	2,179	13,565	15,744	5,407	1,553	350	7,310	23,054	1,687	24,741
1928	2,049	13,120	15,169	5,409	1,686	479	7,574	22,743	1,942	24,685
1929	2,008	14,017	16,025	6,044	2,062	474	8,580	24,605	1,929	26,534

[1] Less than 0.5.

[2] No figures for water power are available before 1889. The fuel equivalent for water power is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 per cent for manufactures and mines and of 40 per cent for public utilities and assuming that the theoretical thermal equivalent of 1 horsepower-hour (2,547 B. t. u.) is 7 per cent of the B. t. u. that would have been consumed in generating 1 horsepower-hour from fuels in practice. For 1919 to 1929, however, actual reports of the horsepower-hours produced by water in electric-utility plants, as recorded by the U. S. Geological Survey, have been used.

[3] Based on the amount of coal displaced by gas, as estimated by the gas companies at the time.

[4] Imports negligible before 1913.

To make comparison easier the figures of heat units are reduced to index numbers in Table 8, with the year 1918 taken as 100. The production of bituminous coal is seen to be 8 per cent less in 1929 than in 1918. The production of all coal was 10 per cent less than in 1918. On the contrary, the production of oil was 183 per cent and the production of natural gas 166 per cent greater. Meanwhile, imports of oil increased 110 per cent, and the total supply of energy in the form of oil and gas from all sources increased 174 per cent over that in 1918. In the same period water power increased 130 per cent. The total production of energy in 1929 was 21 per cent above that of 1918.

Of the total energy in the mineral fuels in 1929 coal supplied 65.1 per cent and oil and gas 34.9 per cent. The water power developed was equivalent to only 7.8 per cent of the fuel total. (See fig. 43.) Details are given in Table 9.

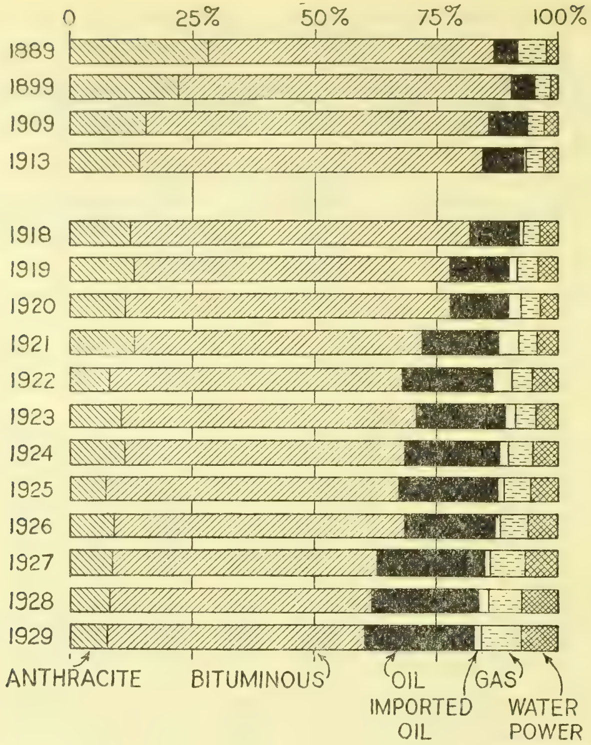

FIGURE 43.—Per cent of the energy supply of the United States derived from coal, oil and gas, and water power, 1889-1929

TABLE 8.—*Relative rates of growth of coal, oil, and water power in the United States, 1819–1929*

[The figures for 1918 are represented by the number 100, and the figures for all other years are expressed as a percentage of the 1918 rate]

Year	Anthracite	Bituminous coal	Total coal	Domestic oil (total crude, including that refined)	Natural gas (total production)	Imported oil (total crude, including that refined)	Total oil and gas	Total mineral fuels	Water power	Grand total, including water power
1819	(1)	--------	(1)	--------	--------	--------	--------	(1)	(2)	(2)
1829	(1)	(1)	(1)	--------	--------	--------	--------	(1)	(2)	(2)
1839	1	(1)	(1)	--------	--------	--------	--------	(1)	(2)	(3)
1849	4	(1)	1	--------	--------	--------	--------	1	(2)	(2)
1859	10	1	2	(1)	--------	--------	(1)	2	(2)	(2)
1869	17	3	5	1	--------	--------	1	4	(2)	(2)
1879	31	6	10	6	(1)	--------	4	9	(2)	(2)
1889	46	17	21	10	35	--------	15	20	11	20
1899	61	33	37	16	31	--------	19	35	16	34
1909	82	66	68	51	67	(3)	52	66	49	65
1913	93	83	84	70	81	45	71	82	70	82
1918	100	100	100	100	100	100	100	100	100	100
1919	89	80	81	106	103	140	108	86	107	86
1920	91	98	97	124	111	282	132	102	116	103
1921	92	72	74	132	92	333	137	84	109	85
1922	55	73	70	156	106	338	157	83	122	85
1923	94	97	97	206	140	218	191	111	136	112
1924	89	83	84	201	158	207	191	100	139	102
1925	63	90	86	215	165	164	199	103	154	105
1926	85	99	97	217	182	160	204	113	178	115
1927	81	89	88	253	201	155	233	110	202	113
1928	76	86	85	253	218	212	241	108	232	113
1929	75	92	90	283	266	210	274	117	230	121

[1] Less than 0.5.
[2] No data for water power prior to 1889.
[3] Imports negligible prior to 1913.

TABLE 9.—*Per cent of total heating value contributed by the several mineral fuels in the United States, 1819–1929*

Year	Anthracite	Bituminous coal	Total coal	Domestic oil (total crude, including that refined)	Natural gas (total production)	Imported oil (total crude, including that refined)	Total oil and gas	Total mineral fuels	Water power, per cent of fuels [1]
1819	100.0	--------	100.0	--------	--------	--------	--------	100.0	(1)
1829	58.4	41.6	100.0	--------	--------	--------	--------	100.0	(1)
1839	40.2	59.8	100.0	--------	--------	--------	--------	100.0	(1)
1849	62.8	37.2	100.0	--------	--------	--------	--------	100.0	(1)
1859	62.3	37.7	100.0	(2)	--------	--------	--------	100.0	(1)
1869	51.3	45.9	97.2	2.8	(2)	--------	2.8	100.0	(1)
1879	42.5	51.3	93.8	6.2	(2)	--------	6.2	100.0	(1)
1889	29.3	59.3	88.6	5.0	6.4	--------	11.4	100.0	2.2
1899	22.5	69.5	92.0	4.7	3.3	--------	8.0	100.0	1.9
1909	16.0	72.2	88.2	8.0	3.8	(2)	11.8	100.0	3.0
1913	14.4	72.7	87.1	8.7	3.6	0.6	12.9	100.0	3.4
1918	12.8	72.3	85.1	10.1	3.7	1.1	14.9	100.0	4.0
1919	13.3	67.9	81.2	12.6	4.5	1.7	18.8	100.0	5.0
1920	11.4	69.3	80.7	12.4	4.0	2.9	19.3	100.0	5.0
1921	14.0	61.7	75.7	16.0	4.0	4.3	24.3	100.0	5.1
1922	8.5	63.3	71.8	19.1	4.7	4.4	28.2	100.0	5.9
1923	10.9	63.5	74.4	18.9	4.6	2.1	25.6	100.0	4.9
1924	11.4	60.2	71.6	20.4	5.8	2.2	28.4	100.0	5.5
1925	7.8	63.3	71.1	21.3	5.9	1.7	28.9	100.0	6.0
1926	9.7	63.3	73.0	19.5	6.0	1.5	27.0	100.0	6.3
1927	9.5	58.8	68.3	23.5	6.7	1.5	31.7	100.0	7.3
1928	9.0	57.7	66.7	23.8	7.4	2.1	33.3	100.0	8.5
1929	8.1	57.0	65.1	24.6	8.4	1.9	34.9	100.0	7.8

[1] No figures for water power are available before 1889; hence to make the figures comparable the data for water power thereafter are expressed as per cent of the fuel total but are not included in the base on which the percentages are computed.

[2] Less than 0.1 per cent.

PRODUCTION

PRODUCTION SUMMARIES, BY STATES

TABLE 10.—*Comparison of bituminous coal produced, by States, 1913, 1923, 1928, and 1929*

State	Production (net tons)				Per cent of increase or decrease		
	1913	1923	1928	1929	1913–1929	1923–1929	1928–29
Alabama	17,678,522	20,457,649	17,621,362	17,943,923	+1.5	−12.3	+1.8
Arkansas	2,234,107	1,296,892	1,660,973	1,695,108	−24.1	+30.7	+2.1
Colorado	9,232,510	10,346,218	9,847,707	9,920,741	+7.5	−4.1	+.7
Georgia	255,626	75,620	58,390	44,636	−82.5	−41.0	−23.6
Illinois	61,618,744	79,310,075	55,948,199	60,657,641	−1.6	−23.5	+8.4
Indiana	17,165,671	26,229,099	16,378,580	18,344,358	+6.9	−30.1	+12.0
Iowa	7,525,936	5,710,735	3,683,635	4,241,069	−43.6	−25.7	+15.1
Kansas	7,202,210	4,443,149	2,809,724	2,975,971	−58.7	−33.0	+5.9
Kentucky	19,616,600	44,777,317	61,860,379	60,462,600	+208.2	+35.0	−2.3
Maryland	4,779,839	2,285,926	2,686,979	2,649,114	−44.6	+15.9	−1.4
Michigan	1,231,786	1,172,075	617,342	804,869	−34.7	−31.3	+30.4
Missouri	4,318,125	3,403,151	3,732,421	4,030,311	−6.7	+18.4	+8.0
Montana	3,240,973	3,147,678	3,324,195	3,407,526	+5.1	+8.3	+2.5
New Mexico	3,708,806	2,915,173	2,711,851	2,622,769	−29.3	−10.0	−3.3
North Dakota	495,320	1,385,400	1,649,930	1,862,130	+275.9	+34.4	+12.9
Ohio	36,200,527	40,546,443	15,641,225	23,689,477	−34.6	−41.6	+51.5
Oklahoma	4,165,770	2,885,038	3,501,325	3,774,080	−9.4	+30.8	+7.8
Pennsylvania	173,781,217	171,879,913	131,202,163	143,516,241	−17.4	−16.5	+9.4
South Dakota	10,540	10,379	13,929	12,854	+22.0	+23.8	−7.7
Tennessee	6,860,184	6,040,268	5,610,959	5,405,464	−21.2	−10.5	−3.7
Texas	2,429,144	1,187,329	1,182,034	1,100,668	−54.7	−7.3	−6.9
Utah	3,254,828	4,720,217	4,842,544	5,160,521	+58.5	+9.3	+6.6
Virginia	8,828,068	11,761,643	11,900,933	12,748,306	+44.4	+8.4	+7.1
Washington	3,877,891	2,926,392	2,519.901	2,521,327	−35.0	−13.8	+.1
West Virginia	71,254,136	107,899,941	132,952,159	138,518,855	+94.4	+28.4	+4.2
Wyoming	7,393,066	7,575,031	6,571,683	6,704,790	−9.3	−11.5	+2.0
Other States	75,151	175,911	214,448	173,244	+130.5	−1.5	−19.2
	478,435,297	564,564,662	500,744,970	534,988,593	+11.8	−5.2	+6.8

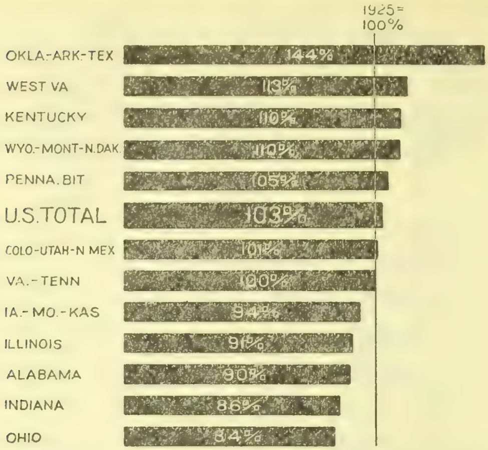

Figure 44.—How production of bituminous coal in 1929 compared with that of 1925 in the principal groups of States. Figures represent the percentage that the production in 1926 formed of that in 1923

Table 11.—*Coal produced in 1929, by States, and highest recorded production*

State	1929 (net tons)	Maximum production	
		Year	Net tons
Alabama	17,943,923	1926	21,000,962
Alaska	100,610	1928	126,100
Arkansas	1,695,108	1907	2,670,438
California, Idaho, and Oregon	[1] 20,454	1880	280,155
Colorado	9,920,741	1917	12,483,336
Georgia	44,636	1903	416,951
Illinois	60,657,641	1918	89,291,105
Indiana	18,344,358	1918	30,678,634
Iowa	4,241,069	1917	8,965,830
Kansas	2,975,971	1918	7,561,947
Kentucky	60,462,600	1927	69,123,998
Maryland	2,649,114	1907	5,532,628
Michigan	804,869	1907	2,035,858
Missouri	4,030,311	1917	5,670,549
Montana	3,407,526	1918	4,532,505
New Mexico	2,622,769	1918	4,023,239
North Carolina	52,180	1922	78,570
North Dakota	1,862,130	1929	1,862,130
Ohio	23,689,477	1920	45,878,191
Oklahoma	3,774,080	1920	4,849,288
Pennsylvania bituminous	143,516,241	1918	178,550,741
South Dakota	12,854	1925	14,447
Tennessee	5,405,464	1910	7,121,380
Texas	1,100,668	1913	2,429,144
Utah	5,160,521	1920	6,005,199
Virginia	12,748,306	1926	14,133,386
Washington	2,521,327	1918	4,082,212
West Virginia	138,518,855	1927	145,122,447
Wyoming	6,704,790	1920	9,630,271
Pennsylvania anthracite	73,828,195	1917	99,611,811

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[1] Includes also Arizona and Nevada.

TOTAL PRODUCTION SINCE BEGINNING OF MINING

TABLE 12.—*Coal produced, by States, 1917–1929, with cumulative total production from the earliest record to the end of 1929, in thousands of net tons*

State	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	Total production from earliest record to end of 1929
Alabama	20, 068	19, 185	15, 537	16, 294	12, 569	18, 325	20, 458	19, 130	20, 004	21, 001	19, 766	17, 621	17, 944	541, 464
Arkansas	2, 143	2, 227	1, 429	2, 103	1, 228	1, 110	1, 297	1, 452	1, 220	1, 459	1, 549	1, 661	1, 695	62, 617
Colorado	12, 483	12, 408	10, 323	12, 278	9, 123	10, 020	10, 346	10, 444	10, 311	10, 637	9, 724	9, 848	9, 921	340, 508
Georgia	119	67	53	50	34	61	76	75	66	60	77	58	45	10. 740
Illinois	86, 199	89, 291	60, 863	88, 725	69, 603	58, 468	79, 310	68, 323	66, 909	69, 367	46, 848	55, 948	60, 658	2, 048, 643
Indiana	26, 539	30, 679	20, 912	29, 351	20, 319	19, 133	26, 229	21, 480	21, 225	23, 186	17, 936	16, 379	18, 344	597, 085
Iowa	8, 966	8, 192	5, 625	7, 814	4, 531	4, 335	5, 711	5, 468	4, 715	4, 626	2, 950	3, 684	4, 241	279. 786
Kansas	7, 185	7, 562	5, 225	5, 926	3, 467	2. 955	4, 443	4, 248	4, 524	4, 416	3, 444	2, 810	2, 976	209, 445
Kentucky	27, 808	31, 613	30, 036	35, 691	31, 588	42, 134	44, 777	45, 147	55, 069	62. 924	69, 124	61, 860	60, 463	873, 502
Maryland	4, 746	4, 497	3, 022	4. 065	1, 828	1, 223	2, 286	2, 134	2, 695	3, 078	2, 815	2, 687	2, 649	226, 152
Michigan	1, 375	1, 465	996	1, 490	1, 142	929	1, 172	831	808	687	757	617	805	39, 605
Missouri	5, 670	5, 668	3, 980	5, 370	3, 551	2, 925	3, 403	2, 481	2, 694	3, 008	3, 064	3, 733	4, 030	182, 236
Montana	4, 227	4, 532	3, 236	4, 414	2, 734	2, 572	3, 148	2, 905	3, 044	2, 798	3, 144	3, 324	3, 408	94, 113
New Mexico	4, 001	4, 023	3. 139	3, 683	2, 453	3, 147	2, 915	2, 786	2, 557	2, 818	2, 935	2. 712	2, 623	92, 799
North Carolina	--------	1	7	12	23	78	36	57	65	58	53	61	52	982
North Dakota	791	720	841	949	865	1, 327	1, 385	1, 200	1, 325	1, 370	1, 528	1. 650	1, 862	22, 906
Ohio	40, 749	45, 813	35, 877	45, 878	31, 943	26, 954	40, 547	30, 473	28, 034	27, 873	15, 800	15, 641	23, 689	1, 167, 954
Oklahoma	4, 387	4, 813	3, 802	4, 849	3, 363	2, 803	2, 885	2, 330	2, 326	2. 843	3. 818	3, 501	3, 774	116, 258
Oregon	28	13	18	21	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	[2] 2, 380
Pennsylvania bituminous	172, 448	178, 551	150, 758	170, 608	116, 014	113, 148	171, 880	130, 634	136, 928	153, 642	132, 965	131, 202	143, 516	5, 109, 872
Tennessee	6, 194	6, 831	5, 213	6, 662	4, 460	4, 877	6, 040	4, 557	5, 454	5, 789	5. 783	5, 611	5, 405	214, 438
Texas	2, 356	2, 261	1, 681	1, 615	973	1, 106	1, 187	1, 147	1, 008	1, 091	1, 326	1, 182	1, 101	51, 984
Utah	4, 125	5, 137	4, 631	6, 005	4, 079	4, 992	4, 720	4, 488	4, 690	4, 374	4, 781	4, 843	5, 161	106, 059
Virginia	10, 087	10, 290	9, 327	11, 379	7, 492	10, 491	11, 762	10, 693	12, 800	14, 133	12, 916	11, 901	12, 748	268, 096
Washington	4, 010	4, 082	2, 990	3. 757	2. 429	2, 581	2, 927	2, 654	2, 538	2, 587	2, 635	2, 520	2, 521	111, 222
West Virginia	86, 442	89, 936	79, 037	89, 971	72, 787	80, 488	107, 900	101, 663	122, 381	143, 509	145, 122	132, 952	138, 519	2, 413, 547
Wyoming	8, 576	9, 439	7, 220	9, 630	7, 201	5, 972	7, 575	6, 757	6, 553	6, 512	6. 754	6, 572	6, 705	235, 146
Other States	68	90	82	77	123	114	150	129	110	121	149	167	134	45, 734
Total bituminous	551, 790	579, 386	465, 860	568, 667	415, 922	422, 268	564, 565	483, 686	520, 053	573, 367	517, 763	500, 745	534, 989	15, 464, 373
Pennsylvania anthracite	99, 612	98, 826	88, 092	89, 598	90, 473	54, 683	93, 339	87, 927	61, 817	84, 437	80, 096	75, 348	73, 828	3, 792, 168
Grand total	651, 402	678, 212	553, 952	658, 265	506, 395	476, 951	657, 904	571, 613	581, 870	657, 804	597, 859	576, 093	608, 817	19, 256, 541

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[1] Included under "Other States."

[2] Total through 1920.

PRODUCTION, BY FIELDS

Many requests are received for information on production by trade fields as distinct from States and counties. In Table 13 the operators' reports to the Bureau of Mines have been retabulated according to the 92 fields into which the United States Coal Commission grouped the bituminous-coal mines. Corresponding figures for 1920 and 1921 will be found in Coal in 1923, pages 534 and 535; for 1922 and 1924, in Coal in 1924, pages 471 and 472; for 1925, in Coal in 1925, pages 417 and 418; for 1926, in Coal in 1926, pages 460 and 461; for 1927, in Coal in 1927, pages 354 and 355; and for 1928, in Coal in 1928, pages 455 and 456. Data on production by fields in 1917 and 1918 are given in Coal in 1918, Part A, page 705. The grouping of the fields used therein is that adopted for administrative purposes by the United States Fuel Administration and is explained on page 114 of Part I of the Report of the Distribution Division of the Fuel Administration. This grouping differs from that of the United States Coal Commission.

The commission's grouping of the fields was made under the direction of C. E. Lesher and R. A. Walter, primarily with a view to its studies of cost of production. The fields are accurately delimited by metes and bounds on pages 2034 to 2052 of the commission's report. Because all the fields adopted did not coincide with generally accepted trade districts they were designated by number rather than by name. For the convenience of the reader of Table 13, however, the trade name most nearly corresponding to the boundaries established by the commission is also listed.

TABLE 13.—*Bituminous coal produced and number of mines active in the several fields adopted by the United States Coal Commission, 1923 and 1929*

[The definitions of these fields are given in detail on pages 2034–2052, Pt. IV of the report of the U. S. Coal Commission]

U. S. Coal Commission field No.	State	General name of field	1923		1929	
			Number of mines	Production (net tons)	Number of mines	Production (net tons)
1	Pennsylvania	Pittsburgh	452	42,209,000	225	33,414,000
2	do	Connellsville	312	37,882,000	140	36,647,000
3	do	Westmoreland-Ligonier	171	14,563,000	79	11,600,000
4a,b	do	Freeport (thick and thin)	123	12,338,000	85	9,860,000
5	do	Butler-Mercer	110	2,587,000	64	1,760,000
6	do	Blossburg	20	496,000	12	178,000
7	do	Broad Top	63	1,430,000	39	1,218,000
8	do	Somerset	232	5,772,000	109	6,350,000
9a	do	Central Pennsylvania, western.	1,385	54,364,000	65	2,959,000
9b	do	Central Pennsylvania, middle.			126	9,632,000
9c	do	Central Pennsylvania, eastern.			501	29,899,000
10	Maryland-West Virginia	Maryland-Potomac	159	3,890,000	103	4,371,000
11	West Virginia	Fairmont	309	22,883,000	136	23,739,000
12	Ohio-West Virginia	Panhandle-Pittsburgh No. 8	233	25,529,000	168	18,769,000
13	do	Pomeroy	41	1,309,000	26	687,000
14	West Virginia	Putnam County	10	345,000	3	444,000
15	Kentucky-West Virginia	Kenova	38	2,103,000	17	3,111,000
16	do	Thacker	89	6,149,000	46	8,909,000
17	West Virginia	Tug River	87	4,555,000	54	8,441,000
18	Virginia-West Virginia	Pocahontas	107	16,481,000	81	22,738,000
19	West Virginia	Winding Gulf	78	7,228,000	59	11,593,000
20	do	New River	145	8,810,000	101	13,602,000
21	do	Kanawha	285	12,741,000	110	17,331,000
22	do	Coal River	29	1,397,000	11	2,276,000
23	do	Logan	155	12,831,000	72	18,581,000
24a	do	Coal and Coke	39	1,158,000	7	860,000
24b	do	Preston County	58	1,937,000	29	1,638,000
24c	do	Taylor County, Junior, Philippi, and Gauley.	176	6,140,000	76	4,536,000
25	Virginia	Southwestern Virginia	123	8,148,000	62	8,302,000
26	do	Clinch Valley	34	2,464,000	17	2,462,000

TABLE 13.—*Bituminous coal produced and number of mines active in the several fields adopted by the United States Coal Commission, 1923 and 1929*—Continued

[The definitions of these fields are given in detail on pages 2034–2052, Pt. IV of the report of the U. S. Coal Commission]

U. S. Coal Commission field No.	State	General name of field	1923		1929	
			Number of mines	Production (net tons)	Number of mines	Production (net tons)
27	Virginia	Virginia "anthracite"[1]	[2] 8	[2] 217,000	8	269,000
28	do	Richmond Basin	(2)	(2)	------	------
29	Ohio	Massillon-Palmyra-Lisbon	90	2,815,000	90	1,487,000
30	do	Coshocton-Goshen	155	3,174,000	145	2,096,000
31	do	Cambridge	55	4,780,000	45	2,310,000
32	do	Crooksville	60	1,015,000	54	528,000
33	do	Hocking	241	7,517,000	97	3,803,000
34	do	Jackson and Ironton	89	610,000	52	397,000
36	Kentucky	Northeast Kentucky	225	9,602,000	115	13,669,000
37	do	Hazard	128	6,660,000	73	7,424,000
38	do	Harlan	75	8,752,000	57	14,340,000
39	Kentucky-Tennessee	Southern Appalachian	221	6,765,000	102	6,821,000
40	do	Jellico	55	1,003,000	23	709,000
41	Kentucky	Western Kentucky	172	10,890,000	144	14,437,000
42	Tennessee	Rockwood-Soddy	89	2,563,000	35	2,121,000
43	do	Fentress	13	541,000	7	673,000
44	Alabama	Big Seam Group	45	5,954,000	50	6,031,000
45	Alabama-Georgia	Cahaba Group	109	5,846,000	85	5,325,000
46	Alabama	Pratt Group	137	8,696,000	68	6,632,000
47	Indiana	Indiana	272	25,793,000	153	18,204,000
48	do	Brazil Block	29	345,000	13	140,000
49	Illinois	Northern Illinois	60	2,334,000	43	1,787,000
50	do	Fulton-Peoria	119	4,190,000	151	4,109,000
51	do	Danville	32	4,178,000	46	3,049,000
52	do	Central Illinois	108	25,205,000	78	17,204,000
53	do	Belleville	106	10,193,000	82	6,368,000
54	do	Murphysboro	10	557,000	11	536,000
55	do	Southern Illinois	140	32,595,000	117	27,605,000
56	Michigan	Michigan	13	1,172,000	7	805,000
57	Arkansas	Sebastian	54	[3] 906,000	33	964,000
58	do	Excelsior-Logan	[3] 21	[3] 106,000	27	304,000
59	do	Arkansas "anthracite"	[3] 19	[3] 221,000	18	427,000
60	Colorado	Colorado "domestic"	145	4,430,000	143	4,243,000
61	do	Trinidad	44	3,182,000	31	2,544,000
62	do	Northern Colorado	47	2,715,000	40	3,134,000
63	Iowa	Marion-Monroe-Polk	89	4,485,000	135	3,172,000
64	do	Appanoose	62	1,217,000	66	1,069,000
65	Kansas	Pittsburg	192	4,135,000	167	2,820,000
66	do	Lightning Creek				
67	do	Osage	27	115,000	30	86,000
68	do	Leavenworth [4]	4	137,000	3	110,000
69	Missouri	Southern Missouri	[5] 79	[5] 2,114,000	112	2,892,000
70	do	Lafayette	69	1,141,000	85	1,098,000
71	do	Grundy	(5)	(5)	(4)	(4)
72	do	Platte	(4)	(4)	(4)	(4)
73	Montana	Montana	48	3,144,000	76	3,408,000
74	New Mexico	Gallup	13	939,000	15	1,100,000
75	do	Cerrillos and Carthage [1]	11	248,000	10	213,000
76	do	Raton	15	1,678,000	13	1,285,000
76a	do	Monero	3	33,000	4	25,000
77	North Dakota	Southern North Dakota	72	910,000	100	1,128,000
78	do	Northern North Dakota	50	447,000	43	734,000
79	Oklahoma	McAlester Vein	25	640,000	26	542,000
80	do	Oklahoma, Eastern	90	2,200,000	107	3,232,000
81	Texas	Texas (bituminous)	10	175,000	4	110,000
82	do	Texas (lignite)	34	1,012,000	20	991,000
83	Utah	Utah	37	4,720,000	42	5,161,000
84	Washington	Kittitas County	12	1,358,000	7	1,089,000
85	do	Pierce-King (bituminous)	[3] 18	[3] 738,000	16	425,000
86	do	Subbituminous [1]	[3] 26	[3] 830,000	25	1,006,000
87	Wyoming	Wyoming	62	7,559,000	54	6,705,000
88	South Dakota	South Dakota	15	10,000	14	13,000
89	Oregon	Oregon	(6)	(6)	(6)	(6)
90	California [6]	California [6]	5	20,000	5	10,000
91	Nevada	Nevada	------	------	(6)	(6)
92	North Carolina	North Carolina	2	36,000	1	52,000
	Unclassified		12	120,000	11	111,000
			9,331	563,422,000	6,057	534,989,000

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[1] Name of field 27 changed from Upper New River to Virginia "anthracite"; field 75 changed from Anthracite to Cerrillos and Carthage; and of field 86 from Lewis to Subbituminous.

[2] Virginia "anthracite" field includes Richmond Basin field (No. 28).

[3] Revised figures.

[4] Leavenworth field, Kansas, includes Platte field, Missouri (No. 72) in 1923 and 1929 and Grundy field, Missouri (No. 71) in 1929.

[5] Southern Missouri field includes Grundy field (No. 71) in 1923.

[6] California includes Idaho and Oregon in 1923 and Idaho, Nevada, and Oregon in 1929.

PRODUCTION, BY GEOLOGIC PROVINCES

TABLE 14.—*Production of bituminous coal and lignite, by geologic provinces, in 1913 and 1917–1929, in net tons*

[The production statistics compiled by the Bureau of Mines are usually arranged by States and counties in alphabetical order. In the following table they are regrouped to accord roughly with broad geologic provinces. This grouping will be found useful in studying the degree of exhaustion of the resources and the competitive position of the several fields because the natural conditions that largely control the cost of mining are closely related to the geology]

Province	1913	1917	1918	1919	1920	1921	1922
Northern and Middle Appalachians (Pennsylvania, Ohio, Maryland, West Virginia, Eastern Kentucky, Virginia, and Tennessee)	312, 863, 044	338, 259, 270	356, 731, 603	304, 636, 935	353, 217, 522	257, 496, 572	265, 580, 998
Southern Appalachians (Alabama)	17, 678, 522	20, 068, 074	19, 184, 962	15, 536, 721	16, 294, 099	12, 568, 899	18, 324, 740
Northern Interior (Michigan)	1, 231, 786	1, 374, 805	1, 464, 818	996, 545	1, 489, 765	1, 141, 715	929, 390
Eastern Interior (Illinois, Indiana, and Western Kentucky)	87, 241, 942	122, 953, 196	130, 768, 429	90, 407, 132	129, 111, 736	98, 538, 128	91, 334, 748
Northwestern Interior (Iowa, Missouri, and Kansas)	19, 046, 271	21, 821, 354	21, 421, 872	14, 829, 214	19, 109, 889	11, 549, 654	10, 215, 081
Middle Western Interior (Arkansas and Oklahoma)	6, 399, 877	6, 530, 423	7, 040, 816	5, 231, 133	6, 952, 884	4, 590, 400	3, 912, 557
Southwestern Interior (Texas, bituminous)	1, 247, 988	1, 259, 276	1, 074, 183	734, 087	545, 227	210, 638	265, 179
Gulf Coast (Texas, lignite)	1, 181, 156	1, 096, 539	1, 186, 952	946, 569	1, 069, 788	762, 201	840, 828
Northern Great Plains (North Dakota, lignite)	495, 320	790, 548	719, 733	840, 959	948, 625	864, 903	1, 327, 564
Rocky Mountains (Montana, Wyoming, Colorado, Utah, and New Mexico)	26, 830, 183	33, 411, 401	35, 538, 828	28, 549, 606	36, 011, 001	25, 589, 650	26, 702, 723
Pacific Coast (Washington)	3, 877, 891	4, 009, 902	4, 082, 212	2, 990, 447	3, 757, 093	2, 428, 722	2, 581, 165
Grand total[1]	478, 435, 297	551, 790, 563	579, 385, 820	465, 860, 058	568, 666, 683	415, 921, 950	422, 268, 099

Province	1923	1924	1925	1926	1927	1928	1929
Northern and Middle Appalachians (Pennsylvania, Ohio, Maryland, West Virginia, Eastern Kentucky, Virginia, and Tennessee)	374, 301, 172	316, 280, 532	351, 173, 229	394, 884, 385	363, 320, 442	345, 577, 581	372, 552, 909
Southern Appalachians (Alabama)	20, 457, 649	19, 130, 184	20, 004, 395	21, 000, 962	19, 765, 866	17, 621, 362	17, 943, 923
Northern Interior (Michigan)	1, 172, 075	831, 020	808, 233	686, 707	756, 763	617, 342	804, 869
Eastern Interior (Illinois, Indiana, and Western Kentucky)	116, 429, 453	98, 823, 565	100, 320, 882	108, 016, 952	85, 988, 572	88, 603, 995	93, 439, 147
Northwestern Interior (Iowa, Missouri, and Kansas)	13, 557, 035	12, 197, 063	11, 933, 309	12, 050, 462	9, 457, 727	10, 225, 780	11, 247, 351
Middle Western Interior (Arkansas and Oklahoma)	4, 181, 930	3, 781, 118	3, 545, 879	4, 301, 690	5, 366, 888	5, 162, 298	5, 469, 188
Southwestern Interior (Texas, bituminous)	175, 332	163, 196	182, 680	170, 494	156, 899	117, 849	109, 606
Gulf Coast (Texas, lignite)	1, 011, 997	983, 815	825, 695	920, 664	1, 169, 486	1, 064, 185	991, 062
Northern Great Plains (North Dakota, lignite)	1, 385, 400	1, 200, 527	1, 324, 620	1, 370, 244	1, 527, 939	1, 649, 930	1, 862, 130
Rocky Mountains (Montana, Wyoming, Colorado, Utah, and New Mexico)	28, 704, 317	27, 381, 151	27, 154, 662	27, 138, 989	27, 338, 388	27, 297, 980	27, 816, 347
Pacific Coast (Washington)	2, 926, 392	2, 653, 667	2, 537, 890	2, 586, 568	2, 635, 062	2, 519, 901	2, 521, 327
Grand total[1]	564, 564, 662	483, 686, 538	520, 052, 741	573, 366, 985	517, 763, 352	500, 744, 970	534, 988, 593

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[1] Totals include Alaska, Arizona, California, Georgia, Idaho, Nebraska, Nevada, North Carolina, Oregon, and South Dakota, which are not covered by the group totals above.

PRODUCTION, BY WEEKS AND MONTHS

The following tables summarize the statistics of the weekly and monthly production of bituminous coal that are first published in the Bureau of Mines weekly coal reports. The figures given are estimates based upon daily and weekly reports of cars of coal and beehive coke loaded by the principal railroads and of shipments over the Monongahela, Allegheny, Ohio, and Kanawha Rivers. The estimates are afterwards revised to agree with the results of the annual statistical reports from the producers of coal; therefore, the figures given here differ slightly from the estimates originally issued in the weekly reports.

If production in February, with 28 days, is compared to that in January, with 31 days, a downward drop is often seen, which may give a mistaken impression as to the real trend. A better indication is afforded by the average production per working day, and it is the practice of the Bureau of Mines in tables of monthly or weekly coal production to show the average per working day as well as the total for the period. Christmas and Fourth of July are universally observed at the mines. A number of other holidays are observed in some districts but not in others. New Year's Day is very generally observed, but in 1929 so many mines continued at work on that day that over the country, as a whole, the day counted for four-tenths of a normal working day. February 22, on the other hand, is little observed as a holiday. Table 16 shows the allowances made in the bureau's records for holidays at the bituminous mines in the last eight years. These allowances are made in the light of the daily reports of cars of coal loaded, collected by the American Railway Association. Loadings on the holiday are compared with those on the corresponding day of the weeks immediately preceding and following, and the degree of holiday observance is computed accordingly. After allowing for the observance of holidays the weighted average potential working year for the country, as a whole, in 1929 was 307.5 days.

As may be seen from Table 15, the weekly rate of output was well above 11,000,000 for 21 weeks out of the 52 and averaged over 10,000,000 tons for the year as a whole.

An indicator of the month-to-month activity in the various mining districts is found in the detailed statistics showing monthly output in the various States. (See Table 18.)

TABLE 15.—*Estimated weekly production of bituminous coal in 1929*

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 5	[1] 8,305,000	[1] 4.4	[2] 1,857,000	July 20	9,370,000	6	1,562,000
Jan. 12	11,884,000	6	1,981,000	July 27	9,655,000	6	1,609,000
Jan. 19	11,900,000	6	1,983,000	Aug. 3	9,395,000	6	1,566,000
Jan. 26	11,988,000	6	1,998,000	Aug. 10	9,745,000	6	1,624,000
Feb. 2	11,889,000	6	1,982,000	Aug. 17	9,714,000	6	1,619,000
Feb. 9	12,292,000	6	2,049,000	Aug. 24	10,154,000	6	1,692,000
Feb. 16	12,160,000	6	2,027,000	Aug. 31	10,886,000	6	1,814,000
Feb. 23	11,967,000	6	1,995,000	Sept. 7	9,509,000	5.3	1,794,000
Mar. 2	11,358,000	6	1,893,000	Sept. 14	11,062,000	6	1,844,000
Mar. 9	10,447,000	6	1,741,000	Sept. 21	11,068,000	6	1,845,000
Mar. 16	9,761,000	6	1,627,000	Sept. 28	11,662,000	6	1,944,000
Mar. 23	8,563,000	6	1,427,000	Oct. 5	11,314,000	6	1,886,000
Mar. 30	8,090,000	6	1,348,000	Oct. 12	11,787,000	6	1,965,000
Apr. 6	7,781,000	5.6	1,389,000	Oct. 19	11,354,000	6	1,892,000
Apr. 13	8,398,000	6	1,400,000	Oct. 26	11,625,000	6	1,938,000
Apr. 20	8,809,000	6	1,468,000	Nov. 2	11,266,000	6	1,878,000
Apr. 27	9,285,000	6	1,548,000	Nov. 9	11,285,000	5.9	1,913,000
May 4	8,942,000	6	1,490,000	Nov. 16	10,740,000	5.7	1,884,000
May 11	9,310,000	6	1,552,000	Nov. 23	11,173,000	6	1,862,000
May 18	9,103,000	6	1,517,000	Nov. 30	10,176,000	5.2	1,957,000
May 25	9,332,000	6	1,555,000	Dec. 7	11,942,000	6	1,990,000
June 1	8,589,000	5.4	1,591,000	Dec. 14	11,805,000	6	1,968,000
June 8	9,324,000	6	1,554,000	Dec. 21	11,360,000	6	1,893,000
June 15	9,478,000	6	1,580,000	Dec. 28	7,816,000	5	1,563,000
June 22	9,245,000	6	1,541,000	Jan. 4	[1] 4,123,000	[1] 2	[2] 1,887,000
June 29	9,648,000	6	1,608,000				
July 6	7,550,000	5	1,510,000		534,989,000	307.5	1,740,000
July 12	9,605,000	6	1,601,000				

[1] Figures represent the output and the number of working days in that part of the week included in the calendar year shown. Figures of total production for these weeks are as follows: Jan. 5, 1929, 10,030,000 tons; Jan. 4, 1930, 10,190,000 tons.

[2] Average daily production for the entire week and not for the working days that fell in the calendar year shown.

TABLE 16.—*Holidays commonly recognized in the bituminous-coal fields and the average fraction of a working day for the country, as a whole, that each holiday represented, 1922–1929*

	Average fraction of full working day							
	1922	1923	1924	1925	1926	1927	1928	1929
January: New Year's Day	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.4
February: Washington's Birthday	(1)	.9	.8	.9	.9	.9	.9	(2)
April: Eight-Hour Day (Apr. 1)	.3	.4	.5	.6	.7	.7	.7	.6
May: Memorial Day	.8	.3	.4	.4	.4	.4	.4	.4
July: Independence Day	-------	-------	-------	-------	-------	-------	-------	-------
September: Labor Day	.3	.3	.3	.4	.4	.4	.4	.3
November:								
General election	-------	-------	.4	-------	.7	-------	.4	.9
Armistice Day	.5	.4	.6	.7	.7	.7	.7	.7
Thanksgiving Day	.2	.1	.2	.3	.5	.1	.2	.2
December: Christmas Day	-------	-------	-------	-------	-------	-------	-------	-------

(1) Data for weighting not available.

(2) Full working day.

TABLE 17.—*Estimated monthly production of bituminous coal and average production per working day, 1926–1929,*[1] *in thousands of net tons*

Month	1926		1927		1928		1929	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	53, 205	2, 103	56, 660	2, 240	44, 925	1, 776	52, 398	1, 985
February	46, 180	1, 932	52, 697	2, 205	42, 022	1, 688	48, 137	2, 006
March	45, 744	1, 694	59, 911	2, 219	44, 668	1, 654	40, 068	1, 541
April	39, 738	1, 546	34, 538	1, 344	32, 710	1, 324	37, 565	1, 467
May	38, 727	1, 525	35, 256	1, 388	37, 218	1, 410	40, 908	1, 550
June	41, 635	1, 601	36, 483	1, 403	36, 546	1, 406	38, 771	1, 551
July	43, 102	1, 658	33, 505	1, 340	36, 864	1, 475	41, 379	1, 592
August	45, 957	1, 767	41, 541	1, 539	41, 774	1, 547	44, 695	1, 655
September	48, 559	1, 912	41, 763	1, 644	41, 971	1, 720	45, 334	1, 866
October	54, 127	2, 082	43. 827	1, 686	51, 176	1, 895	52. 174	1, 932
November	59, 213	2, 378	40, 468	1, 632	46, 788	1, 925	46, 514	1, 876
December	57, 180	2, 199	41, 114	1, 581	44, 083	1, 763	47, 046	1, 882
	573, 367	1, 864	517, 763	1, 684	500, 745	1, 631	534, 989	1, 740

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[1] Monthly statistics from 1905 to 1925 will be found in Coal in 1922, pp. 464–465, and in Coal in 1925, p. 423.

TABLE 18.—*Estimated monthly production of coal, by States, in 1929, in thousands of net tons*

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,689	1,582	1,483	1,517	1,515	1,317	1,416	1,479	1,426	1,678	1,183	1,659	17,944
Arkansas	218	215	81	59	58	64	91	121	188	219	176	205	1,695
Colorado	1,219	1,160	695	613	540	437	498	614	904	992	1,147	1,102	9,921
Illinois	7,202	6,707	4,411	3,647	3,847	3,423	3,885	4,521	4,915	5,906	5,585	6,609	60,658
Indiana	1,909	1,926	1,524	1,114	1,329	1,206	1,277	1,385	1,464	1,713	1,587	1,910	18,344
Iowa	452	493	318	251	263	232	255	298	361	400	454	464	4,241
Kansas	385	370	231	144	149	155	183	237	261	313	264	284	2,976
Kentucky:													
Eastern	4,210	3,964	3,213	3,202	3,748	3,583	3,800	4,089	4,076	4,582	3,697	3,861	46,025
Western	1,818	1,600	1,085	904	926	812	902	1,097	1,213	1,434	1,245	1,401	14,437
Maryland	282	253	227	184	187	192	191	204	200	253	233	243	2,649
Michigan	77	75	61	53	61	56	62	73	69	77	72	69	805
Missouri	462	440	305	248	268	246	259	255	327	385	390	445	4,030
Montana	347	360	254	196	217	188	212	278	318	370	349	319	3,408
New Mexico	272	231	201	207	197	182	208	197	197	256	251	224	2,623
North Dakota	269	245	109	85	60	48	46	60	233	220	236	251	1,862
Ohio	1,973	1,859	1,563	1,609	1,721	1,795	1,995	2,079	2,068	2,553	2,121	2,353	23,689
Oklahoma	530	445	233	157	167	174	233	263	345	395	430	402	3,774
Pennsylvania bituminous	12,916	11,718	11,503	11,147	11,844	11,447	11,925	12,215	11,806	13,446	12,072	11,477	143,516
Tennessee	510	493	414	390	444	402	416	457	451	504	455	470	5,406
Texas	109	101	89	84	88	77	96	107	89	96	70	95	1,101
Utah	683	597	373	323	267	235	247	322	452	554	583	525	5,161
Virginia	1,174	1,130	1,009	951	1,048	951	975	1,058	1,097	1,207	1,085	1,063	12,748
Washington	274	281	201	196	171	177	154	179	201	221	227	239	2,521
West Virginia	12,660	11,227	9,969	9,824	11,363	11,006	11,647	12,587	12,016	13,605	11,876	10,739	138,519
Wyoming	736	647	500	442	418	357	394	500	634	765	699	613	6,705
Other States	22	18	16	18	12	9	12	20	23	30	27	24	231
Total bituminous	52,398	48,137	40,068	37,565	40,908	38,771	41,379	44,695	45,334	52,174	46,514	47,046	534,989
Pennsylvania anthracite	7,068	6,425	4,859	6,205	6,077	4,883	4,810	5,735	6,543	8,026	5,820	7,377	73,828
Grand total	59,466	54,562	44,927	43,770	46,985	43,654	46,189	50,430	51,877	60,200	52,334	54,423	608,817

TABLE 19.—*Estimated daily output of coal, by States, in each month of 1929, in thousands of net tons*

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	64.0	65.9	57.1	59.3	57.4	52.7	54.5	54.8	58.7	62.2	47.7	66.4	58.3
Arkansas	8.3	8.9	3.1	2.3	2.2	2.6	3.5	4.5	7.7	8.1	7.1	8.2	5.5
Colorado	46.2	48.3	26.7	23.9	20.5	17.5	19.2	22.8	37.2	36.7	46.3	44.1	32.3
Illinois	272.8	279.4	169.7	142.5	145.7	136.9	149.4	167.5	202.3	218.7	225.2	264.4	197.3
Indiana	72.3	80.2	58.6	43.5	50.3	48.2	49.1	51.3	60.3	63.4	64.0	76.4	59.7
Iowa	17.1	20.5	12.2	9.8	10.0	9.3	9.8	11.1	14.9	14.8	18.3	18.6	13.8
Kansas	14.6	15.4	8.9	5.6	5.6	6.2	7.0	8.8	10.7	11.6	10.7	11.3	9.7
Kentucky:													
Eastern	159.5	165.2	123.6	125.1	142.0	143.3	146.2	151.4	167.7	169.7	149.1	154.4	149.7
Western	68.9	66.7	41.7	35.3	35.1	32.5	34.7	40.6	49.9	53.1	50.2	56.0	46.9
Maryland	10.7	10.5	8.7	7.2	7.1	7.7	7.3	7.6	8.2	9.4	9.4	9.7	8.6
Michigan	2.9	3.1	2.4	2.1	2.3	2.2	2.4	2.7	2.8	2.8	2.9	2.8	2.6
Missouri	17.5	18.3	11.7	9.7	10.2	9.8	10.0	9.4	13.5	14.3	15.7	17.8	13.1
Montana	13.1	15.0	9.8	7.7	8.2	7.5	8.1	10.3	13.1	13.7	14.1	12.8	11.1
New Mexico	10.3	9.6	7.8	8.1	7.5	7.3	8.0	7.3	8.1	9.5	10.1	9.0	8.5
North Dakota	10.2	10.2	4.2	3.3	2.3	1.9	1.8	2.2	9.6	8.2	9.5	10.0	6.0
Ohio	74.7	77.4	60.1	62.9	65.2	71.8	76.7	77.0	85.1	94.6	85.5	94.1	77.0
Oklahoma	20.1	18.5	9.0	6.1	6.3	7.0	9.0	9.7	14.2	14.6	17.3	16.1	12.3
Pennsylvania bituminous	489.2	488.2	442.4	435.4	448.6	457.9	458.6	452.4	485.8	498.0	486.8	459.1	466.7
Tennessee	19.3	20.5	15.9	15.2	16.8	16.1	16.0	16.9	18.6	18.7	18.4	18.8	17.6
Texas	4.1	4.2	3.4	3.3	3.3	3.1	3.7	4.0	3.7	3.6	2.8	3.8	3.6
Utah	25.9	24.9	14.4	12.6	10.1	9.4	9.5	11.9	18.6	20.5	23.5	21.0	16.8
Virginia	44.5	47.1	38.8	37.1	39.7	38.0	37.5	39.2	45.1	41.7	43.7	42.5	41.5
Washington	10.4	11.7	7.7	7.7	6.5	7.1	5.9	6.6	8.3	8.2	9.1	9.6	8.2
West Virginia	479.5	467.8	383.4	383.7	430.4	440.2	448.0	466.2	494.5	503.9	478.9	429.5	450.5
Wyoming	27.9	26.9	19.2	17.3	15.8	14.3	15.1	18.5	26.1	28.3	28.2	24.5	21.8
Other States	.8	.7	.6	.7	.4	.3	.5	.7	.9	1.1	1.1	.9	.7
Total bituminous	1,984.8	2,005.1	1,541.1	1,467.4	1,549.5	1,550.8	1,591.5	1,655.4	1,865.6	1,932.4	1,875.6	1,881.8	1,739.8
Pennsylvania anthracite	271.8	273.4	186.9	248.2	233.7	195.3	185.0	212.4	272.6	308.7	242.5	295.1	213.3
Grand total	2,256.6	2,278.5	1,728.0	1,715.6	1,783.2	1,746.1	1,776.5	1,867.8	2,138.2	2,241.1	2,118.1	2,176.9	1,983.1

MONTHLY PRODUCTION OF BITUMINOUS COAL, LESS COAL EQUIVALENT OF COKE MADE

If a statistical series presenting bituminous-coal output is desired, which can be used without double counting in conjunction with a series on monthly coke production, it is necessary to deduct the coal equivalent of all coke—beehive and by-product—from the total production of coal.[3] This is done in Table 20 for the period 1922 to 1929.

Examination of the continuous monthly series over a long period may be interesting to students of the business cycle. Data for the period 1912 to 1921 are given in Coal in 1928, page 463, and comparable current figures can be determined easily from the bureau's weekly coal reports.

TABLE 20.—*Monthly production of bituminous coal less coal equivalent of coke made in the same month, 1922–1929, in thousands of net tons* [1]

Month	1922	1923	1924	1925	1926	1927	1928	1929
January	35, 395	44, 991	46, 165	44, 865	45, 452	50, 059	38, 651	45, 349
February	38, 933	37, 042	41, 038	32, 594	38, 826	46, 549	35, 978	41, 533
March	47, 665	40, 830	34, 465	30, 845	38, 396	52, 901	38, 034	32, 557
April	12, 280	36, 473	24, 328	27, 471	32, 925	27, 952	26, 392	30, 390
May	16, 601	39, 840	26, 967	29, 494	31, 900	28, 794	30, 647	33, 218
June	18, 580	39, 591	27, 033	31, 481	35, 094	30, 377	30, 294	31, 296
July	13, 245	39, 342	29, 170	33, 969	36, 376	27, 492	30, 734	33, 759
August	23, 258	43, 394	31, 656	39, 130	39, 331	35, 464	35, 495	37, 096
September	38, 221	41, 038	37, 825	40, 791	41, 965	35, 843	35, 707	38, 158
October	41, 248	44, 255	43, 174	46, 410	47, 227	37. 801	44, 361	44, 767
November	40, 833	38, 308	36, 824	43, 444	52, 424	34, 822	40, 106	39, 616
December	41, 670	35, 101	40, 066	45, 027	50, 580	35, 261	37, 162	40, 464
	367, 929	480, 205	418, 711	445, 521	490, 496	443, 315	423, 561	448, 203

[1] The figures represent all bituminous coal produced other than that made into coke and therefore include coal-mine fuel, local sales for all purposes other than coke making, and shipments for all purposes other than coke making.

They are obtained by subtracting from the figures of total production for the month the coal equivalent of the beehive and by-product coke made in the same month. This coal equivalent can be computed with great accuracy from the known production of coke. There is, however, a time discrepancy of unknown and varying amount between the coal production series and the coke production series, which arises from the fact that coal charged into by-product ovens must ordinarily be shipped some distance from the mine and that the by-product plants maintain stocks of coal to even up irregularities in their receipts, which stocks fluctuate between 11 and 42 days' supply. The error introduced by this time discrepancy is seldom serious, however, the less so because in the case of beehive coke the production of raw coal and its conversion into coke are one continuous process.

NUMBER AND SIZE OF MINES

The fundamental unit in the statistical record of the bureau is the mine, and operating companies are asked to make a separate report for each mine. For most purposes the mine is a better unit than the company. The mine's location is definitely known and can be related to a specific field or county. Its identity can be followed through successive changes of ownership; and it is the natural operating unit from the point of view of cost, mechanical equipment, mining practice, accident hazards, and output per man per day. The number of mines is naturally much greater than the number of operating companies.

Tables 21 to 23 show the number of active mines, not including those idle or abandoned. Table 21 emphasizes the large number in operation during periods of high prices. The peak was reached in

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[3] Tryon, F. G., Monthly Production of Anthracite Coal and Shipments and Production of Beehive Coke: Rev. Econ. Statistics, October, 1926, pp. 199–204.

1920, when spot prices averaged $5.64 a ton and sales realizations on all coal, including contract deliveries, $3.75 a ton. In that year the bureau received reports from 14,766 mines of all kinds in operation, including several thousand wagon mines. The number of commercial mines in that year was 8,921.

As already explained (p. 692), no attempt has been made to collect data on the wagon mines during the years of depression, and since 1923 the record covers commercial mines only. It is well known, however, that thousands of wagon mines which sprang up mushroomlike in the period of high prices have since disappeared.

Table 22 covers the commercial mines only and classifies them by size. Class 1A includes mines producing over 500,000 tons; class 1B those producing less than 500,000 but more than 200,000 tons; class 2 those producing 200,000 to 100,000 tons; and so on down to class 5, which includes mines producing less than 10,000 tons. It is important to note that the classification is based not on capacity, but on the year's production; hence, a mine in class 2 this year may drop to class 3 the next, and in years of dull market and short working time the number in the smaller-size groups is increased by this fact.

With these qualifications understood Table 22 brings out clearly the long-time changes. The number of operating mines of all sizes increased fairly steadily up to the period of the war, climbed rapidly to a peak in 1920–1923, and has since declined. The reduction has come chiefly in the intermediate size classes. There has been an actual increase in the number of large mines and with it gradual concentration of more and more of the output in the larger units. In 1905, 40.2 per cent of the bituminous production came from class 1 mines. By 1923 the proportion had increased to 47.2 per cent and by 1929 had risen to 65.2.

Table 23 shows in detail the number of mines in each size class and in each State for 1929.

TABLE 21.—*Number of mines operating and price of bituminous coal f. o. b. mines, 1913 and 1917–1929*

Year	Number of commercial bituminous mines in operation	Total number of bituminous mines in operation, including wagon mines	Average spot price f. o. b. mines (Coal Age)	Average sales realization per ton on all coal f. o. b. mines
1913	5,776	(1)	$1.23	$1.18
1917	6,939	10,634	3.25	2.26
1918	8,319	11,038	[2] 2.58	2.58
1919	8,994	12,409	2.59	2.49
1920	8,921	14,766	5.64	3.75
1921	8,038	(1)	2.55	2.89
1922	9,299	14,150	3.64	3.02
1923	9,331	11,715	$2.77	$2.68
1924	7,586	(1)	2.08	2.20
1925	7,144	(1)	2.06	2.04
1926	7,177	(1)	2.21	2.06
1927	7,011	(1)	1.99	1.99
1928	6,450	(1)	1.80	1.86
1929	6,057	(1)	1.79	1.78

[1] Not available.

[2] Price fixed by fuel administrator.

TABLE 22.—*Number and yearly output of commercial bituminous-coal mines, by size classes, 1905, 1910, 1913 and 1917–1929* [1]

[Exclusive of wagon mines]

Year	Class 1 (more than 200,000 tons) [2]	Class 2 (100,000 to 200,000 tons)	Class 3 (50,000 to 100,000 tons)	Class 4 (10,000 to 50,000 tons)	Class 5 (less than 10,000 tons)	Total
Number of mines:						
1905	411	612	808	1,514	1,715	5,060
1910	618	763	960	1,568	1,909	5,818
1913	694	837	959	1,558	1,728	5,776
1917	792	914	1,044	1,996	2,193	6,939
1918	821	929	1,198	2,636	2,735	8,319
1919	550	854	1,181	2,784	3,625	8,994
1920	701	1,031	1,279	3,160	2,750	8,921
1921	482	807	1,003	2,346	3,400	8,038
1922	416	848	1,084	3,139	3,812	9,299
1923	748	935	1,176	2,742	3,730	9,331
1924	646	819	943	2,047	3,131	7,586
1925	714	833	891	1,969	2,737	7,144
1926	823	845	867	1,912	2,730	7,177
1927	779	818	879	1,831	2,704	7,011
1928	773	687	725	1,513	2,752	6,450
1929	827	660	668	1,361	2,541	6,057
Net tons produced:						
1905	126,499,000	85,920,000	57,386,000	38,995,000	6,034,000	314,834,000
1910	191,519,000	107,052,000	68,858,000	42,282,000	6,561,000	416,272,000
1913	241,463,000	118,476,000	69,018,000	42,292,000	6,280,000	477,529,000
1917	285,366,000	129,486,000	74,894,000	51,596,000	8,824,000	550,166,000
1918	281,267,000	131,027,000	87,143,000	67,453,000	11,387,000	578,277,000
1919	174,848,000	120,926,000	84,625,000	71,334,000	13,198,000	464,931,000
1920	237,468,000	142,750,000	90,669,000	82,129,000	10,716,000	563,732,000
1921	162,438,000	115,607,000	71,160,000	56,099,000	10,618,000	415,922,000
1922	131,876,000	117,195,000	77,287,000	77,203,000	15,248,000	418,809,000
1923	265,869,000	130,804,000	84,342,000	68,769,000	13,639,000	563,423,000
1924	237,338,000	115,217,000	67,967,000	52,606,000	10,559,000	483,687,000
1925	279,190,000	117,986,000	64,578,000	48,900,000	9,399,000	520,053,000
1926	333,047,000	120,598,000	62,650,000	47,616,000	9,456,000	573,367,000
1927	283,654,000	115,506,000	63,712,000	45,987,000	8,904,000	517,763,000
1928	304,248,000	96,950,000	52,197,000	38,694,000	8,656,000	500,745,000
1929	349,025,000	95,783,000	48,400,000	33,827,000	7,954,000	534,989,000
Per cent of total number of mines:						
1905	8.1	12.1	16.0	29.9	33.9	100.0
1910	10.6	13.1	16.5	27.0	32.8	100.0
1913	12.0	14.5	16.6	27.0	29.9	100.0
1917	11.4	13.2	15.0	28.8	31.6	100.0
1918	9.8	11.2	14.4	31.7	32.9	100.0
1919	6.1	9.5	13.1	31.0	40.3	100.0
1920	7.9	11.6	14.3	35.4	30.8	100.0
1921	6.0	10.0	12.5	29.2	42.3	100.0
1922	4.5	9.1	11.7	33.7	41.0	100.0
1923	8.0	10.0	12.6	29.4	40.0	100.0
1924	8.5	10.8	12.4	27.0	41.3	100.0
1925	10.0	11.6	12.5	27.6	38.3	100.0
1926	11.5	11.8	12.1	26.6	38.0	100.0
1927	11.1	11.7	12.5	26.1	38.6	100.0
1928	12.0	10.6	11.2	23.5	42.7	100.0
1929	13.6	10.9	11.0	22.5	42.0	100.0
Per cent of total tonnage:						
1905	40.2	27.3	18.2	12.4	1.9	100.0
1910	46.0	25.7	16.5	10.2	1.6	100.0
1913	50.6	24.8	14.4	8.9	1.3	100.0
1917	51.9	23.5	13.6	9.4	1.6	100.0
1918	48.6	22.7	15.1	11.6	2.0	100.0
1919	37.6	26.0	18.2	15.4	2.8	100.0
1920	42.1	25.3	16.1	14.6	1.9	100.0
1921	39.1	27.8	17.1	13.5	2.5	100.0
1922	31.5	28.0	18.5	18.4	3.6	100.0
1923	47.2	23.2	15.0	12.2	2.4	100.0
1924	49.0	23.8	14.1	10.9	2.2	100.0
1925	53.7	22.7	12.4	9.4	1.8	100.0
1926	58.1	21.0	10.9	8.3	1.7	100.0
1927	54.8	22.3	12.3	8.9	1.7	100.0
1928	60.7	19.4	10.4	7.7	1.8	100.0
1929	65.2	17.9	9.1	6.3	1.5	100.0

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[1] This table shows mines, not companies, and should not be confused with other tables that include country banks and many wagon mines shipping by rail.

[2] Figures for 1924–1929 include classes 1A and 1B.

TABLE 23.—*Number and production of commercial bituminous-coal mines, by size classes in each State, in 1929*

[No canvass of wagon mines producing less than 1,000 tons was made]

State	Class 1A (more than 500,000 tons)					Class 1B (200,000 to 500,000 tons)					Class 2 (100,000 to 200,000 tons)					Class 3 (50,000 to 100,000 tons)				
	Mines		Production			Mines		Production			Mines		Production			Mines		Production		
	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent
Alabama	6	3.0	4,172,814	695,469	23.3	15	7.4	4,821,023	321,402	26.9	33	16.3	4,458,988	135,121	24.8	42	20.8	3,337,204	79,457	18.6
Alaska																1	14.2	54,765	54,765	54.4
Arizona																				
Arkansas											1	1.3	104,405	104,405	6.1	10	12.8	706,256	70,626	41.7
California, Idaho, Nevada, and Oregon																				
Colorado						15	7.0	4,375,447	291,696	44.1	17	7.9	2,390,531	140,619	24.1	28	13.1	1,943,128	69,397	19.6
Georgia																				
Illinois	43	8.2	34,829,914	809,998	57.4	49	9.3	16,130,420	329,192	26.6	35	6.6	5,032,744	143,793	8.3	34	6.4	2,329,768	68,523	3.9
Indiana	6	3.6	3,632,488	605,415	19.8	29	17.5	9,633,988	332,206	52.5	19	11.5	2,727,589	143,557	14.9	15	9.0	1,045,565	69,704	5.7
Iowa						5	2.5	1,380,889	276,178	32.6	7	3.5	1,019,495	145,642	24.0	8	4.0	621,554	77,694	14.7
Kansas						2	1.0	465,971	232,986	15.7	6	3.0	886,315	147,719	29.8	6	3.0	418,517	69,753	14.0
Kentucky:																				
Eastern	9	2.5	6,741,438	749,049	14.7	70	19.6	21,881,711	312,596	47.6	65	18.2	9,351,273	143,866	20.3	74	20.7	5,384,118	72,758	11.7
Western	1	.7	554,007	554,007	3.8	28	19.4	7,909,620	282,486	51.8	27	18.8	3,789,341	140,346	26.2	16	11.1	1,041,269	65,079	7.2
Maryland						2	2.6	462,718	231,359	17.5	7	9.0	910,327	130,047	34.4	8	10.2	539,192	67,399	20.3
Michigan						2	28.6	460,847	230,424	57.2	1	14.2	178,358	178,358	22.2	2	28.6	136,645	68,323	17.0
Missouri						3	1.5	740,303	246,768	18.4	8	4.0	1,047,467	130,933	26.0	9	4.5	624,827	69,425	15.5
Montana	2	2.6	1,836,475	918,238	53.9	2	2.6	455,713	227,857	13.4	4	5.3	603,818	150,955	17.7	3	4.0	225,482	75,161	6.6
New Mexico	1	2.4	512,938	512,938	19.6	2	4.7	429,775	214,888	16.4	6	14.3	805,988	134,331	30.7	9	21.4	657,765	73,078	25.1
North Carolina																1	100.0	52,180	52,180	100.0
North Dakota						4	2.8	1,134,041	283,510	60.9	1	.7	150,698	150,698	8.0	2	1.4	111,261	55,631	6.0
Ohio	10	1.6	5,989,234	598,923	25.3	25	4.0	7,074,270	282,971	29.8	33	5.3	4,623,357	140,102	19.5	29	4.7	2,078,006	71,655	8.8
Oklahoma						3	2.3	729,322	243,107	19.3	3	2.3	422,033	140,678	11.2	16	12.0	1,153,540	72,096	30.6
Pennsylvania	73	5.1	58,269,644	798,214	40.6	117	8.1	36,723,380	313,875	25.6	164	11.4	24,208,226	147,611	16.9	171	11.8	12,301,253	71,937	8.6
South Dakota																				
Tennessee						5	6.0	1,450,476	290,095	26.8	10	12.1	1,501,856	150,186	27.9	20	24.1	1,569,436	78,472	29.0
Texas						1	4.1	305,477	305,477	27.8	2	8.3	341,841	170,921	31.1	1	4.2	94,183	94,183	8.5
Utah						8	19.1	2,751,556	343,945	53.3	11	26.2	1,565,204	142,291	30.3	9	21.4	696,040	77,338	13.5
Virginia	7	7.7	4,968,087	709,727	39.0	10	11.0	3,119,045	311,905	24.4	21	23.1	3,137,659	149,412	24.6	9	9.9	659,137	73,237	5.2
Washington						6	12.5	1,658,938	276,490	65.8	2	4.2	297,502	148,751	11.8	2	4.2	163,125	81,563	6.5
West Virginia	50	5.9	36,404,922	728,098	26.3	203	23.9	63,001,408	310,352	45.5	164	19.3	24,278,168	148,038	17.5	135	15.9	9,855,193	73,001	7.1
Wyoming	1	1.8	541,701	541,701	8.1	12	22.2	3,475,137	289,595	51.8	13	24.1	1,949,752	149,981	29.1	8	14.8	600,437	75,055	8.9
	209	3.4	158,453,662	758,151	29.6	618	10.2	190,571,475	308,368	35.6	660	10.9	95,782,935	145,126	17.9	668	11.0	48,399,780	72,455	9.1

TABLE 23.—*Number and production of commercial bituminous-coal mines, by size classes in each State, in 1929*—Continued

State	Class 4 (10,000 to 50,000 tons)					Class 5 (less than 10,000 tons)					Total		
	Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent	Number	Per cent	Total (net tons)	Average per mine (net tons)	Per cent		Total	Average per mine
Alabama	39	19.3	961,532	24,655	5.3	67	33.2	192,362	2,871	1.1	202	17,943,923	88,831
Alaska	2	28.6	43,758	21,879	43.5	4	57.2	2,087	522	2.1	7	100,610	14,373
Arizona	------	------	------	------	------	4	100.0	10,132	2,533	100.0	4	10,132	2,533
Arkansas	33	42.3	754,336	22,859	44.5	34	43.6	130,111	3,827	7.7	78	1,695,108	21,732
California, Idaho, Nevada, and Oregon	------	------	------	------	------	5	100.0	10,322	2,064	100.0	5	10,322	2,064
Colorado	34	15.9	889,028	26,148	9.0	120	56.1	322,607	2,688	3.2	214	9,920,741	46,359
Georgia	1	100.0	44,636	44,636	100.0	------	------	------	------	------	1	44,636	44,636
Illinois	64	12.1	1,523,238	23,801	2.5	303	57.4	811,557	2,678	1.3	528	60,657,641	114,882
Indiana	39	23.5	1,064,641	27,298	5.8	58	34.9	240,087	4,139	1.3	166	18,344,358	110,508
Iowa	34	16.9	862,742	25,375	20.3	147	73.1	356,389	2,424	8.4	201	4,241,069	21,100
Kansas	34	17.2	789,705	23,227	26.5	150	75.8	415,463	2,770	14.0	198	2,975,971	15,030
Kentucky:													
Eastern	91	25.5	2,460,440	27,038	5.3	48	13.5	206,472	4,302	.4	357	46,025,452	128,923
Western	43	29.9	1,019,442	23,708	7.1	29	20.1	123,469	4,258	.9	144	14,437,148	100,258
Maryland	20	25.6	592,967	29,648	22.4	41	52.6	143,910	3,510	5.4	78	2,649,114	33,963
Michigan	2	28.6	29,019	14,510	3.6	------	------	------	------	------	7	804,869	114,981
Missouri	45	22.6	1,213,198	26,960	30.1	134	67.4	404,516	3,019	10.0	199	4,030,311	20,253
Montana	7	9.2	166,710	23,816	4.9	58	76.3	119,328	2,057	3.5	76	3,407,526	44,836
New Mexico	6	14.3	149,498	24,916	5.7	18	42.9	66,865	3,715	2.5	42	2,622,769	62,447
North Carolina	------	------	------	------	------	------	------	------	------	------	1	52,180	52,180
North Dakota	11	7.7	196,657	17,878	10.6	125	87.4	269,473	2,156	14.5	143	1,862,130	13,022
Ohio	122	19.6	2,811,779	23,047	11.9	403	64.8	1,112,831	2,761	4.7	622	23,689,477	38,086
Oklahoma	57	42.8	1,242,624	21,800	32.9	54	40.6	226,561	4,177	6.0	133	3,774,080	28,377
Pennsylvania	415	28.7	9,964,632	24,011	6.9	505	34.9	2,049,106	4,058	1.4	1,445	143,516,241	99,319
South Dakota	------	------	------	------	------	14	100.0	12,854	918	100.0	14	12,854	918
Tennessee	26	31.3	828,970	31,883	15.3	22	26.5	54,732	2,488	1.0	83	5,405,464	65,126
Texas	13	54.2	320,052	24,619	29.1	7	29.2	39,115	5,588	3.5	24	1,100,668	45,861
Utah	5	11.9	130,949	26,190	2.6	9	21.4	16,772	1,864	.3	42	5,160,521	122,870
Virginia	27	29.7	817,561	30,280	6.4	17	18.6	46,817	2,754	.4	91	12,748,306	140,091
Washington	11	22.8	303,746	27,613	12.0	27	56.3	98,016	3,630	3.9	48	2,521,327	52,528
West Virginia	175	20.6	4,538,761	25,936	3.3	123	14.4	440,403	3,581	.3	850	138,518,855	162,963
Wyoming	5	9.3	105,892	21,178	1.6	15	27.8	31,871	2,125	.5	54	6,704,790	124,163
	1,361	22.5	33,826,513	24,854	6.3	2,541	42.0	7,954,228	3,130	1.5	6,057	534,988,593	88,326

NUMBER AND SIZE OF COMPANIES, AS DISTINCT FROM MINES

NUMBER OF COMPANIES IN 1929

To develop the number of producing companies, as distinct from the number of mines, a special analysis of the returns for 1929 was made and is compared in Table 24 with a similar study in 1920.[4] In preparing the table every corporation (or partnership or individual operator) reporting to the bureau has been counted as one producer or "company," and no account has been taken of interlocking ownership or interests. The table therefore understates somewhat the degree of concentration of ownership in the bituminous coal-mining industry. To give a single illustration, the several producing companies affiliated with the United States Steel Corporation are shown not as one but as individual companies. Thus, the Tennessee Coal, Iron, & Railroad Co., producing in Alabama and Tennessee; the United States Coal & Coke Co., operating in Kentucky and West Virginia; the H. C. Frick Coke Co., largest of the producers in the Connellsville region; and the United States Fuel Co., mining in southern Illinois, are counted in the tables as separate corporations. If they were thrown together to represent a single financial interest the degree of concentration would appear increased. The change would not alter the essential picture, however, which shows a very large number of producing interests competing for a limited business.

No attempt was made in 1929 to count the wagon mines, which had been so numerous in the golden days of 1920. In that year the bureau's record showed a total of 1,440 country banks (undoubtedly incomplete) and 4,405 wagon mines shipping by rail, the two groups together producing 4,934,711 tons. Under the market conditions of 1929 the tonnage from these tiny workings was undoubtedly small.

The number of commercial operators in 1929 was found to be 4,612. Of these there were 2,337 producing less than 10,000 tons a year; at the other extreme were 70 companies, operating 416 mines, that produced 1,000,000 to 3,000,000 tons; and 17 companies, with 221 mines, that produced over 3,000,000 tons.

TABLE 24.—*Bituminous coal-mining operations, classified by size of producing company, 1920 and 1929*

Size of company	Number of producers in each class		Number of mines operated		Total output (net tons)	
	1920	1929	1920	1929	1920	1929
Country banks reporting	1,440	([a])	1,440	([a])	420,911	([a])
Wagon mines shipping by rail, other than local commercial mines	4,405	([a])	4,405	([a])	4,513,800	([a])
Commercial operators producing:[b]						
Under 10,000 tons	2,349	2,277	2,393	2,337	8,779,772	6,914,484
10,000 to 50,000 tons	2,121	1,043	2,381	1,166	53,348,269	26,050,740
50,000 to 100,000 tons	727	408	974	500	51,242,458	29,287,670
100,000 to 200,000 tons	543	331	888	473	75,508,562	46,537,397
200,000 to 500,000 tons	348	335	791	591	105,376,323	106,434,219
500,000 to 1,000,000 tons	109	131	519	353	75,153,363	90,800,724
1,000,000 to 3,000,000 tons	64	70	637	416	109,873,689	122,651,595
3,000,000 tons and over	16	17	338	221	84,449,536	106,311,764
Total, commercial	6,277	4,612	8,921	6,057	563,731,972	534,988,593
Grand total	12,122	([a])	14,766	([a])	568,666,683	([a])

[a] No canvass of country banks and wagon mines made. Production of both groups in 1929 was undoubtedly small.

[b] Includes small operators sometimes referred to as "local commercial" in previous reports.

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[4] Tryon, F. G., and Hale, S. A., Coal: United States Geol. Survey Mineral Resources of the United States, 1922, Part II, pp. 535-545.

REDUCTION IN NUMBER OF OPERATING COMPANIES

Table 25, which includes commercial operations only, shows the changes in number of producing companies over a long enough period to indicate clearly the trend. The following analysis is abstracted from a paper by members of the bureau, published in Coal Age.[5]

Since 1920, a total of 1,665 operators have been forced out of the bituminous-coal industry. In that year, which marked the culmination of the war boom, 6,277 corporations, partnerships, or individuals were engaged in mining soft coal on a commercial scale. In 1929, the number had fallen to 4,612. The elimination of these unfortunate producers testifies to the ruthlessness of the competitive struggle in recent years, but in one sense it represents progress. It is a sign of the drastic liquidation of excess productive facilities which the industry has already accomplished; and with excess capacity thus reduced, prospects are more favorable for the stronger companies that have managed to survive.

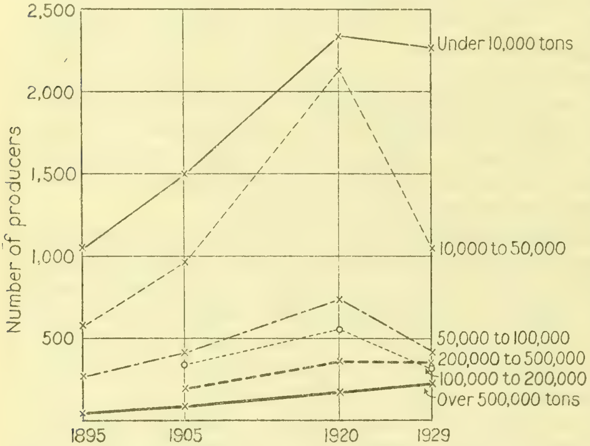

FIGURE 45.—Number of companies producing bituminous coal, classified by size of output, 1895-1929. Note that figures represent companies rather than mines; wagon mines are not included

The liquidation has chiefly affected the small—but not the smallest—groups of companies. As Figure 45 shows, all sizes of companies grew in number from 1895 (the year of the first record) to 1920. The drop since 1920 has been sharpest in the class producing 10,000 to 50,000 tons a year. In this class the decrease amounts to 51 per cent. A very drastic reduction also has marked the groups producing 50,000 to 100,000 and 100,000 to 200,000 tons a year.

Above 200,000 tons, on the other hand, the mortality has been small; in fact, there has been an actual increase in the groups over 500,000 tons. In 1929, 218 companies produced more than one-half million tons, or 29 more than at the peak of the boom. (See Table 25.)

A surprising feature of Figure 45 is the apparent vitality of the smallest producers, the class producing less than 10,000 tons a year. The figures seem to indicate that there are almost as many operators in this class to-day as at the time of the boom. In part, this showing is more apparent than real. Changes in the bureau's methods of collecting data have made its lists of these small operators more complete than they were in 1920, and the figures are not wholly comparable. Furthermore, a good many companies that used to be in the next larger class have since dropped to the smallest class.

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[5] Tryon, F. G., Metcalf, R. W., and Rogers, H. O.; Drastic Liquidation of Excess Mine Capacity Brighten Prospects for Future: Coal Age, February, 1931, pp. 79-81.

There is reason to believe, also, that there has been somewhat less liquidation in this group of smallest operators than in the middle-size groups, or perhaps that the development of new enterprises has been greater.

The group consists largely of what may be called "local commercial" operators. It does not include country coal banks and wagon mines producing less than 1,000 tons, nor the fly-by-nights that sprang up during the 1920 boom and have since disappeared. Many of the operators in this class have been on the bureau's lists for years, producing their small tonnages season after season. They generally serve a local market, often by wagon or truck, and are sheltered from the active competition of the larger producers. Some are cooperative ventures, and others enjoy an advantage in lower wage rates. Protected in this way, surprisingly many local commercial operators have survived the competitive storm. In any case, their history is not of great importance, for even in times of active market they produce less than 2 per cent of the national supply.

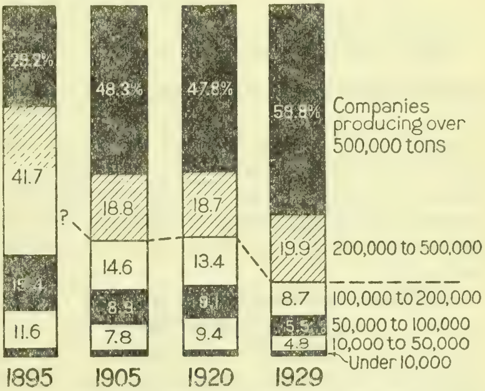

FIGURE 46.—Increase in percentage of total bituminous output contributed by the larger companies. In 1895 the companies producing over 500,000 tons a year accounted for 29.2 per cent of the output; by 1929 their share had risen to 59.8 per cent. Companies producing from 200,000 to 500,000 tons have been holding their own. The shrinkage has come in the smaller companies of less than 200,000 tons. Note that for 1895 the figures do not permit subdividing the companies between 100,000 and 500,000 tons

Wholesale elimination of the small and middle-size producers has tended to concentrate the available tonnage in the hands of the larger companies. Figure 46 shows that between 1895 and 1905 the tonnage contributed by companies producing over 500,000 tons increased from 29.2 to 48.3 per cent of the total output. In the next 15 years there was curiously little change, but since 1920 the large companies have continued to gain at the expense of the smaller ones, and in 1929 they accounted for 59.8 per cent of the total output. The next lower size group (200,000 to 500,000 tons) has just about held its own, accounting for 19.9 per cent of the total output in 1929, as against 18.7 per cent in 1920. The shrinkage has come about in the companies producing less than 200,000 tons. The three groups producing between 200,000 and 10,000 tons have lost from a third to a half of their tonnage. Even the group of little operations producing less than 10,000 tons shows a loss.

In a small measure these changes are due to absorption of companies by merger, which tends of course to diminish the smaller-size groups and to swell the larger ones. The process of amalgamation, however, can account for little of the change. Primarily, it represents defunct corporations and abandoned mines.

TABLE 25.—*Trend of size of bituminous coal-operating companies, 1895–1929*

[Data exclude wagon mines producing less than 1,000 tons a year. Each operating company is treated as one operator, regardless of possible affiliations with other concerns]

Companies producing—	Number of operators				Per cent of total production			
	1895	1905	1920	1929	1895	1905	1920	1929
Less than 10,000 tons	1, 055	1, 492	2, 349	[1] 2, 277	2. 1	1. 6	1. 6	1. 3
10,000 to 50,000	590	961	2, 121	1, 043	11. 6	7. 8	9. 4	4. 8
50,000 to 100,000	285	403	727	408	15. 4	8. 9	9. 1	5. 5
100,000 to 200,000	268	331	543	331	41. 7	14. 6	13. 4	8. 7
200,000 to 500,000		199	348	335		18. 8	18. 7	19. 9
500,000 to 1,000,000	32	49	109	131	29. 2	10. 8	13. 3	17. 0
1,000,000 to 3,000,000		39	64	70		19. 8	19. 5	22. 9
3,000,000 and over		10	16	17		17. 7	15. 0	19. 9
	2, 230	3, 484	6, 277	4, 612	100. 0	100. 0	100. 0	100. 0

[1] Figures for 1929 are not entirely comparable with those for 1920. (See text.)

OPERATING PERFORMANCE OF LARGE AND SMALL COMPANIES

Judged by the record of survival, the companies producing over 200,000 tons a year have a marked competitive advantage over those producing less. Their advantage becomes still clearer if certain tests of efficiency are considered, such as the number of days worked per year and the average output per man per day. This is done in Table 26.

The first step is to separate the captive companies, whose superior market connections give them an artificial advantage in working time. In 1929, 226 companies were controlled by consumers and delivered half or more of their annual output to the consumer owner. Their operations are shown in the lower half of Table 26.

Deducting the 226 captive organizations, there remain 4,386 independent companies, shown in the upper half of the table. They operated a total of 5,570 mines and produced 76.9 per cent of the total output. They reported lower sales realizations than the more fortunate captive mines, worked fewer days, and as a group had a lower output per man per day.

In Figure 47, the operations of the commercial companies are plotted in a way to stress the relation between size of company—shown on the horizontal scale—and efficiency—shown on the vertical scale. It is clear that output per man per day, which is one indicator of cost, increases rapidly with size of company up to a yearly output of about 200,000 tons. From 200,000 tons to 500,000 it continues to increase, but much less rapidly, and beyond 500,000 tons it shows no marked change. Steadiness of operation, which is both cause and effect of variations in cost, shows a parallel relation; the number of days worked per year increases very rapidly up to 200,000 tons a year, then breaks, and beyond 500,000 tons flattens out.

The curve of sales realizations per ton is the reverse of the efficiency curve. Operators producing less than 10,000 tons sold their coal for an average of $2.22 a net ton. That some such price was necessary to enable them to exist is shown by their extremely low output per man-day (2.74 tons) and their short working time (127 days). The next larger group of companies got less—$1.92 a ton—and with each successively larger group the average sales realization falls until it reaches $1.66 for the group producing 500,000 to 1,000,000 tons. From there on the curve flattens like the others.

The position of the small companies is partly explained by the fact that companies with difficult mining conditions naturally tend to be small. To cite an extreme case, the dozen or so operators who work the Osage seam of Kansas—only 21 inches thick—can not, by the nature of things, produce a large tonnage. They and many others working under less difficult conditions, but handicapped in comparison with operators in thick seams, go to swell the smaller-size brackets. It is clear that such operations can survive only where the coal is of exceptional quality or where nearness to market enables producers to command high prices. Thus, a considerable fraction of the companies producing less than 200,000 tons come from Iowa, Missouri, Kansas, Arkansas, and Oklahoma, where difficult mining

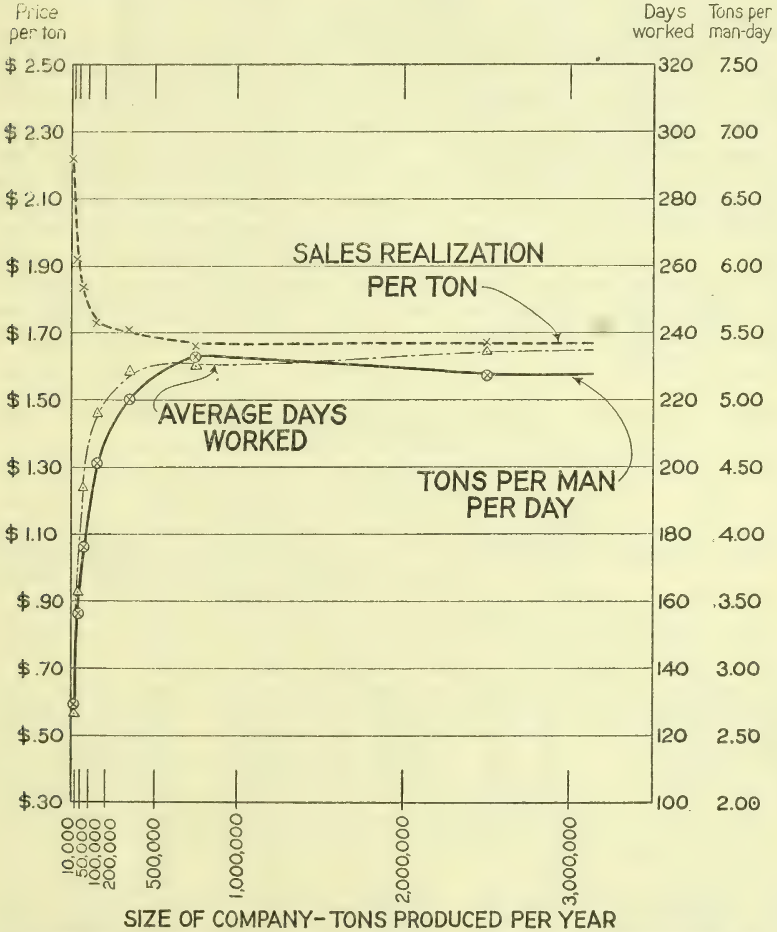

FIGURE 47.—Comparative performance of large and small bituminous mining companies in 1929, excluding captive companies. As size of company increases, average working time and output per man also increase, while average sales realization falls. This is true up to 200,000 or 500,000 tons a year. Above 500,000 tons there is no consistent change

conditions are partly offset by the freight differentials against the more easily won coals of Illinois, western Kentucky, and the Appalachians. Still others of these small operators are serving a local market only by wagon or truck.

With due allowance for this tendency it is evident that the larger companies enjoy a competitive advantage. The relation between small and large companies holds true broadly not only for the United States as a whole but for individual districts.

The most striking fact disclosed by Figure 47 is, however, that above an annual production of about 500,000 tons further increase in size seems to bring no consistent gain in either output per man-day, working time, or price. The averages shown, of course, are made up of widely differing conditions. They include strip and deep mines, mechanized and hand loading, lignite and semibituminous coal, good roofs and bad, and North and South. Further studies of the same data by districts may show a greater advantage accruing to the larger companies. As the figures stand, however, they suggest that companies producing over 200,000 tons enjoy a great advantage over those producing less but that above 500,000 tons, or at the most, 1,000,000, bigness alone is not as great an advantage as might have been supposed.

TABLE 26.—*Bituminous coal-mining operations in the United States in 1929, classified by size of producing company* [1]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average day worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	2,241	2,298	6,730,206	1.3	$2.22	2.74	127	14,953,000	8,223,000
10,000 to 50,000 tons	990	1,104	24,808,138	4.6	1.92	3.42	163	43,360,000	18,552,000
50,000 to 100,000 tons	389	471	27,873,603	5.2	1.84	3.91	194	40,809,000	12,935,000
100,000 to 200,000 tons	302	426	42,399,342	7.9	1.73	4.54	216	55,564,000	13,165,000
200,000 to 500,000 tons	304	528	95,215,469	17.8	1.71	5.02	229	117,604,000	22,388,000
500,000 to 1,000,000 tons	104	291	71,747,400	13.4	1.66	5.32	230	88,877,000	17,130,000
1,000,000 tons and over	56	452	142,741,110	26.7	1.67	5.16	235	173,262,000	30,521,000
Total	4,386	5,570	411,515,268	76.9	1.72	4.77	214	534,429,000	122,914,000
CONSUMER-OWNED [2]									
Under 10,000 tons	36	39	184,278	------	2.02	3.03	192	263,000	79,000
10,000 to 50,000 tons	53	62	1,242,602	.2	2.03	3.74	185	1,969,000	726,000
50,000 to 100,000 tons	19	29	1,414,067	.3	2.08	3.53	187	2,157,000	743,000
100,000 to 200,000 tons	29	47	4,138,055	.8	2.09	3.85	216	5,554,000	1,416,000
200,000 to 500,000 tons	31	63	11,218,750	2.1	2.15	4.30	250	12,610,000	1,391,000
500,000 to 1,000,000 tons	27	62	19,053,324	3.6	1.95	5.45	232	23,744,000	4,691,000
1,000,000 to 3,000,000 tons	24	110	41,312,883	7.7	1.91	5.14	234	49,315,000	8,002,000
3,000,000 tons and over	7	75	44,909,366	8.4	2.02	5.58	259	48,784,000	3,875,000
Total	226	487	123,473,325	23.1	1.99	5.13	240	144,396,000	20,923,000
Grand total	4,612	6,057	534,988,593	100.0	1.78	4.85	219	678,825,000	143,837,000

[1] Excludes wagon mines producing less than 1,000 tons a year. Each operating corporation (or partnership or individual) is treated as 1 operator, regardless of possible affiliations with other corporations.

[2] Includes companies owned by consumers where half or more of annual output is taken by the consumer-owner; if less than half is so taken the company is classified as commercial.

ANALYSIS OF SIZE OF COMPANIES IN THE SEVERAL DISTRICTS, FROM THE VIEWPOINT OF FUTURE CONSOLIDATIONS

Examination of the number and size of producing companies throws light on a subject that has been much discussed among coal operators—the possibilities of consolidation.

The widespread movement toward consolidation, which has been such a conspicuous feature of American business in recent years, and the advantages often obtained thereby have led to many suggestions that consolidations offer a means of mitigating destructive competition in the mining of bituminous coal. The industry has always been marked by intense competition among the thousands of units engaged, and it is well known that since 1923 a combination of factors has caused a prolonged depression. Mine capacity had been greatly increased during the period of high prices, and fuel economy and competition of other sources of power have checked the former growth of demand. The readjustment that inevitably followed has brought hardship to both capital and labor. From 1923 to 1929, a total of 3,274 mines (commercial, not wagon mines), were forced to close, and 202,000 men lost their jobs. In spite of the progress made in reducing surplus capacity, however, competition is still destructively intense, many operators are losing money, and the yearly earnings of miners in many districts are admittedly low.

The very large number of competing units is universally admitted to be one of the fundamental causes of the difficult economic position of the industry. A number of amalgamations in which some strong company has absorbed others have already taken place. Especially interesting have been companies operating in one field acquiring control of mines in an entirely different field, thereby obtaining a wider variety of coals to offer to their customers.

Another type of amalgamation that has been widely discussed is a regional consolidation of the companies operating in a district. Consolidations of this type were effected in the Pittsburgh and Fairmont districts in the past; and in the great depression following the Jacksonville agreement similar projects have been considered in the No. 8 field of Ohio,[6] in northern West Virginia,[7] and in the "smokeless" fields of southern West Virginia.[8]

Among the questions arising in connection with such regional projects are the number of large and small companies operating in the field, their relative production and potential capacity, and (not the least important) the number and importance of the captive operations. Tables 26 and 27 attempt to answer these questions, first for the country as a whole and then for each of the principal districts.

Why 1929 was used.—The year 1929 was selected for the analysis, as it affords a good basis for such a study. The years 1927 and 1928 were discarded because they were distorted by large-scale strikes, and 1930 would not be typical because of the business recession. Demand in 1929 was somewhat above the average, but the experience of that year should be a satisfactory indicator of what may be expected when general business returns to normal.

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[6] Black Diamond, Jan. 31, 1925, p. 119. Coal Age, May 14, 1925, p. 725; July 9, 1925, p. 50; July 30, 1925, p. 157.

[7] Coal Age, Feb. 5, 1925, p. 224; Feb. 12, 1925, p. 258; Mar. 19, 1925, p. 438. Black Diamond, Apr. 4, 1925, p. 400; Aug. 29, 1925, p. 223; Oct. 10, 1925, p. 412.

[8] Coal Age, July, 1928, p. 450.

"Captive" and "independent" companies.—About one-fourth of the production of bituminous coal comes from mines owned or controlled by consumers of coal and known in the trade as "captive" mines.[9] In Tables 26 and 27 the captive companies are shown separately, because they present a special problem in consolidations. Many captive companies are operated solely to supply the needs of the consumer-owner and sell no coal on the commercial market. Such, for example, is the policy of the mines controlled by the railroads and the larger steel companies. Their operations have little effect upon the commercial market. Other consumer-controlled companies, especially those affiliated with the public utilities, the lesser steel companies, and the manufacturing industries, sell their surplus on the commercial market, using the requirements of the consumer-owner as a backlog of steady business and thereby improving their operating time and lowering their per-ton costs. Companies of this type often have an advantage over independent commercial operators, and their attitude toward a proposed consolidation may largely influence its success. Where the commercial sales of a consumer-affiliated company form a large part of its total output, it is not easy to decide whether to classify the company as "captive" or "independent."

In previous compilations (see Coal in 1926, pp. 466–475), the classification of captive or independent was applied to individual mines, and where the consumer-owner utilized the product of certain of the mines only the other mines of the company were classified as independent. In making the present compilation by companies it was necessary to classify the company as a whole either one way or the other; hence, where more than half of the company's tonnage was captive the entire company was classed as captive, and where less than half was captive it was classed as independent. Under this ruling a few cases arose where the company was classed as captive in one district and independent in another. It results unavoidably that some of the tonnage of the "captive" group in the tables is sold on the commercial market and vice versa.

The companies classed as independent had an output of 411,515,000 tons, or 76.9 per cent of the total production. (See Table 26.) This figure indicates approximately the aggregate tonnage sold competitively on the commercial market.

Number of "independent" companies.—Excluding captive operations the total number of independent companies in 1929 was 4,386. In making this count, partnerships and individuals have been reckoned as "companies," the object being to determine the number of business units engaged in the industry. Except in the group producing under 10,000 tons, practically all operators are incorporated.

As already pointed out (p. 715), each corporation reporting to the bureau has been treated as a producing unit, and no account has been taken of interlocking ownership or interest. Numerous instances of financially affiliated corporations will occur to anyone familiar with the industry. Sometimes the relation is that of direct ownership of one company by another, in which case the parent company dictates the policy of the subsidiary. More often it is a community of interest sufficient to influence policy but not to control it, in which case the promoters of a consolidation would have to deal with both companies. The Bureau of Mines has never sought to inquire into such relationships, and in default of accurate information it has seemed best to treat each corporation as a separate business unit. If it were possible to allow for such cases of common ownership, the total number of producing interests would be less than the table shows, and the number in the larger groups—those producing over 500,000 tons, for example—would be greater. Essentially, however, the picture would remain the same—a very large number of producing units struggling for the available business.

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[9] For detailed statistics of captive mines see Tryon, F. G., Kiessling, O. E., and Mann, L., Coal: Bureau of Mines Mineral Resources of the United States, 1926. Part II, pp. 466–475.

For the United States as a whole the number of independent companies in each size class is as follows:

Size of company (annual output):	Number of independent companies
Under 10,000 tons	2,241
10,000 to 50,000 tons	990
50,000 to 100,000 tons	389
100,000 to 200,000 tons	302
200,000 to 500,000 tons	304
500,000 to 1,000,000 tons	104
1,000,000 to 3,000,000 tons	46
3,000,000 tons and over	10
Total	4,386

Production by large and small companies.—In all of the principal districts the larger concerns, while contributing only a small fraction of the number of companies, control a large fraction of the tonnage. Thus, for the country as a whole the 464 independent companies that have an output of 200,000 tons or more control 75.3 per cent of the total commercial tonnage. Likewise, the 89 captive companies with 200,000 tons or more control 94.3 per cent of the total captive tonnage. The percentages for each size class are as follows:

Size of company (yearly output)	Per cent of total output		
	Commercial companies	Captive companies	Total
Under 10,000 tons	1.6	0.1	1.3
10,000 to 50,000 tons	6.1	1.0	4.8
50,000 to 100,000 tons	6.8	1.1	5.5
100,000 to 200,000 tons	10.3	3.4	8.7
200,000 to 500,000 tons	23.1	9.1	19.9
500,000 to 1,000,000 tons	17.4	15.4	17.0
1,000,000 to 3,000,000 tons	19.8	33.5	22.9
3,000 000 tons and over	14.9	36.4	19.9
Total	100.0	100.0	100.0

Prices obtained.—The fifth column of the tables shows the average realization f. o. b. mine. This item is included to give some idea of the quality and grade of the coal produced. Within a given region variations in average sales realizations largely reflect differences in quality of the coal and care in preparation, or differences in the relative percentage of domestic sizes and run-of-mine, screenings, or slack. Thus, in Colorado the coals included range all the way from high-priced anthracite to "black lignite" screenings, and the average realizations are affected accordingly.

From the United States summary it would seem at first glance that small companies get much higher sales realizations than large ones, but this difference is as much apparent as real. As already pointed out (p.717), the smaller companies include a large number of units operating under difficult conditions and sheltered by transportation differentials from the competition of the more efficient mines. Many of the small operators, also, produce only during the fall and winter, when spot prices are at the peak, and are compelled to shut down during the summer through sheer inability to compete. To these factors rather than to superior salesmanship or market connections, the higher realizations frequently reported by the small companies are due.

Tons per man per day—an indicator of cost.—The next column of the tabular analysis shows the average production per man employed (above and below ground) per day. This figure is included to throw some light on production costs. The cost in dollars and cents depends largely on the rate of wages, but within a given district where wages are roughly on a parity the labor cost tends to vary inversely as the output per man per day. The labor cost, of course, by no means tells the whole story, for there are supplies, overhead, and capital charges on equipment to be considered, and many mines with a low labor cost have a high capital cost on account of more extensive use of machinery. In practically all fields, however, labor remains the principal element in cost.

The output per man-day thus gives some indication of comparative costs (where wage rates are equal). It is controlled largely in turn by the physical conditions in the mines, and the mines showing high output per man usually have favorable physical conditions as well. Where strip mining is possible, for example, the output per man-day may be very high. For the country as a whole the relation between size of company and output per man-day is shown graphically in Figure 47.

Average time worked—an indicator of stability.—The seventh column of the tabular analysis shows the average number of days worked by the mines of the companies of each size class. In computing the average the record of each mine was weighted by the number of men employed.

The average working time may be taken as an indicator of competitive standing and relative stability. It was found that working time tends to increase rapidly with size of company up to an output of 200,000 tons a year. The relation is shown in Figure 47.

Potential production.—A point of great interest in any discussion of consolidation is the potential capacity involved, especially the capacity of mines that may not be included in the consolidation. Light is thrown upon this point by the eighth column of the tabular analysis, which shows what the mines could produce if they worked for 280 days at the average daily rate attained during the time they actually did work. Two hundred and eighty days is much less than the theoretical working year, which contains 308 days. Many individual mines, particularly the captive mines, work 300 days or more. The figure of 280 days allows for incidental losses of time through breakdowns, car shortages (now rare), petty strikes, and miners' holidays. It is a conservative measure of the potential output attainable with the mines, equipment, and labor force working in 1929.

Excess of potential over actual production.—By subtracting the actual production from the potential 280-day production, an indication is obtained of the additional production that might be expected if prices and other market conditions permitted, as shown in the ninth column of the tabular analysis. For the independent companies as a group the result is as follows:

Size of company (annual output)	Excess of potential over actual production	Average realization on actual production
Under 10,000 tons	8, 223, 000	$2. 22
10,000 to 50,000 tons	18, 552, 000	1. 92
50,000 to 100,000 tons	12, 935, 000	1. 84
100,000 to 200,000 tons	13, 165, 000	1. 73
200,000 to 500,000 tons	22, 388, 000	1. 71
500,000 to 1,000,000 tons	17, 130, 000	1. 66
1,000,000 to 3,000,000 tons	19, 245, 000	1. 67
3,000,000 tons and over	11, 276, 000	
Total	122, 914, 000	1. 72

It is clear that the companies in all size groups are capable of greatly increased production. The smaller companies, in particular, have a reserve out of all proportion to their present output, because they now work so small a portion of the year. Even the companies producing less than 10,000 tons a year are in a position to throw a large tonnage on the market whenever conditions permit. How large an increase in price would be necessary to call out all of this potential surplus is, of course, highly uncertain. Some indication is afforded by the realization obtained by companies on their actual production. As the companies producing less than 10,000 tons, for example, obtained $2.22 a ton on what they actually did sell it is clear that a price somewhere above $2.22 would be required to call out their potential surplus of 8,223,000 tons. Similarly, companies producing over 500,000 tons a year would have to receive a price somewhere above $1.66 to call out their potential surplus.

In general, the return of even slightly higher prices would tend to draw out some of the potential surplus, and the return of such prices as prevailed in the fall of 1926 would draw out a great deal of it.

It must be remembered that bituminous coal is a commodity of very inelastic demand. An actual shortage sufficient to cut off only a small percentage of the usual consumption, such as occurred during the war or the strikes of 1920 and 1922, may drive up spot prices 100, 200, 300, or even 800 per cent. On the other hand, when the usual demand is satisfied, even a sweeping concession in price has little effect in increasing consumption. Under these circumstances, the offering of even a small additional tonnage exercises a peculiarly depressing influence on the price structure. Recently, for example, odd cars of screenings have sold for as little as 10 cents a ton. It is this inelastic character of coal demand that makes the existence of excess capacity so serious in bituminous-coal mining. Many other industries have an excess of productive facilities, but in coal mining the resulting pressure on the price structure is unusually severe. The result is a chronic "buyers' market," interrupted only by artificial shortages due to transportation or strikes, in which prices lie heavily on or below the production costs of a large group of producers.

For these reasons it is a matter of the greatest importance in weighing the financial prospects of any amalgamation of companies to consider the possible expansion of output by the companies remaining outside.

No account is taken in these tables of possible expansion of tonnage through the sinking of new mines or the reopening of old ones. In almost all districts opportunities for the development of new mines remain, and of the thousands of old mines that have been shut down or abandoned since 1923 many hundreds could doubtless be reconditioned in a few months if the owners thought they saw a chance for profit. It is necessary to mention this point because, in some earlier attempts at amalgamation, new mines developed in the region to such an extent as partly to offset the expected benefits of the amalgamation.

Grouping of the fields shown.—Any grouping of the coal fields is necessarily arbitrary, for the interrelations of such factors as quality of coal, cost of mining, labor policy, market connections, and freight rates are exceedingly complicated, and a grouping that is in harmony with one of these factors may be out of harmony with others.

The United States Coal Commission divided the country into 92 fields for its studies on cost of production. Many of these, however, are very small, and to keep the discussion within bounds they are recombined into 19 larger groups for the purpose of this analysis. The areas covered are explained, where necessary, in the footnotes to Table 27. The boundaries of the original 92 fields are fully described in the commission's report,[10] and statistics of production in each field are given in Table 13.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*

[For explanation of fields included, see text]

WESTERN PENNSYLVANIA FIELDS [a]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	163	169	583,855	0.6	$2.05	3.10	119	1,374,000	790,000
10,000 to 50,000 tons	94	107	2,248,780	2.4	1.76	3.66	185	3,404,000	1,155,000
50,000 to 100,000 tons	37	44	2,687,026	2.9	1.58	4.46	207	3,635,000	948,000
100,000 to 200,000 tons	37	50	5,151,042	5.5	1.61	5.19	203	7,105,000	1,954,000
200,000 to 500,000 tons	29	48	8,423,436	9.0	1.61	5.05	245	9,627,000	1,204,000
500,000 to 1,000,000 tons	11	25	7,680,703	8.2	1.66	[b]4.93	252	8,534,000	853,000
1,000,000 to 3,000,000 tons	5	39	27,430,139	29.5	1.61		264	29,236,000	1,806,000
3,000,000 and over	2	33							
Total	378	515	54,204,981	58.1	1.63	[b]4.84	240	62,915,000	8,710,000
CONSUMER-OWNED									
Under 10,000 tons	9	9	34,120	------	1.76	3.78	188	51,000	17,000
10,000 to 50,000 tons	6	7	149,255	.2	1.86	4.77	105	398,000	249,000
50,000 to 100,000 tons	2	2	312,645	.4	2.14	4.55	229	382,000	69,000
100,000 to 200,000 tons	1	1							
200,000 to 500,000 tons	4	5	1,165,446	1.2	1.97	4.18	279	1,169,000	4,000
500,000 to 1,000,000 tons	7	8	4,813,948	5.2	1.86	6.15	237	5,687,000	873,000
1,000,000 to 3,000,000 tons	7	16	32,600,208	34.9	2.00	5.44	259	35,190,000	2,590,000
3,000,000 and over	2	30							
Total	38	78	39,075,622	41.9	1.99	5.46	255	42,877,000	3,802,000
Grand total	416	593	93,280,603	100.0	1.78	[b]5.09	246	105,792,000	12,512,000

[a] Includes United States Coal Commission fields 1 (Pittsburgh), 2 (Connellsville), 3 (Westmoreland Ligonier), 4 (Freeport).

[b] In calculating average tons per man per day, the 1930 experience of 2 companies was used as being mor representative than that of 1929.

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[10] Report of the United States Coal Commission, vol. 4, 1925, pp. 2034-2052.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

CENTRAL PENNSYLVANIA [c]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	176	193	761, 943	1. 8	$1. 85	2. 92	116	1, 839, 000	1, 077, 000
10,000 to 50,000 tons	140	173	3, 390, 299	8. 0	1. 77	3. 66	160	5, 933, 000	2, 543, 000
50,000 to 100,000 tons	54	80	3, 761, 844	8. 8	1. 81	3. 93	191	5, 515, 000	1, 753, 000
100,000 to 200,000 tons	35	65	4, 835, 972	11. 3	1. 84	3. 86	210	6, 448, 000	1, 612, 000
200,000 to 500,000 tons	23	54	7, 041, 676	16. 5	1. 90	4. 55	221	8, 922, 000	1, 880, 000
500,000 to 1,000,000 tons	6	18	4, 153, 288	9. 7	1. 99	4. 65	252	4, 615, 000	462, 000
1,000,000 to 3,000,000 tons	5	57	10, 400, 203	24. 4	1. 77	4. 89	218	13, 358, 000	2, 958, 000
Total	439	640	34, 345, 225	80. 5	1. 84	4. 31	203	46, 630, 000	12, 285, 000
CONSUMER-OWNED									
Under 10,000 tons	3	3	13, 894	------	2. 77	1. 64	198	20, 000	6, 000
10,000 to 50,000 tons	8	8	183, 576	0. 4	1. 77	3. 20	223	230, 000	46, 000
50,000 to 100,000 tons	3	5	175, 387	. 4	2. 00	3. 01	291	169, 000	−6, 000
100,000 to 200,000 tons	3	11	486, 803	1. 1	2. 44	4. 56	242	563, 000	76, 000
200,000 to 500,000 tons	2	4	2, 060, 106	4. 9	1. 74	3. 52	240	2, 421, 000	361, 000
500,000 to 1,000,000 tons	2	8							
1,000,000 to 3,000,000 tons	3	25	5, 402, 378	12. 7	2. 05	5. 31	212	7, 135, 000	1, 733, 000
Total	24	64	8, 322, 144	19. 5	1. 99	4. 54	224	10, 538, 000	2, 216, 000
Grand total	463	704	42, 667, 369	100. 0	1. 87	4. 35	206	57, 168, 000	14, 501, 000

UPPER POTOMAC, CUMBERLAND-PIEDMONT, SOMERSET, AND BROAD TOP

Companies producing—	Number of companies	Number of mines	Net tons	Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	73	76	280, 396	2. 4	$1. 76	2. 76	146	535, 000	255, 000
10,000 to 50,000 tons	56	69	1, 301, 501	11. 2	1. 66	3. 38	187	1, 964, 000	662, 000
50,000 to 100,000 tons	15	23	1, 061, 943	9. 1	1. 72	3. 37	219	1, 360, 000	298, 000
100,000 to 200,000 tons	18	32	2, 623, 084	22. 6	1. 61	4. 12	234	3, 148, 000	525, 000
200,000 to 500,000 tons	6	25	2, 725, 030	23. 4	1. 79	3. 86	257	2, 966, 000	241, 000
500,000 to 1,000,000 tons	3	18	3, 123, 440	26. 8	1. 84	3. 69	278	3, 173, 000	50, 000
Total	171	243	11, 115, 394	95. 5	1. 74	3. 72	235	13, 146, 000	2, 031, 000
CONSUMER-OWNED									
100,000 to 200,000 tons	4	5	525, 987	4. 5	1. 81	4. 82	228	646, 000	120, 000
Grand total	175	248	11, 641, 381	100. 0	1. 74	3. 76	235	13, 792, 000	2, 151, 000

NORTHERN WEST VIRGINIA [d]

Companies producing—	Number of companies	Number of mines	Net tons	Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	41	51	189, 427	0. 6	$1. 32	4. 01	96	552, 000	363, 000
10,000 to 50,000 tons	65	69	1, 650, 818	5. 4	1. 34	4. 31	171	2, 703, 000	1, 052, 000
50,000 to 100,000 tons	22	25	1, 522, 008	4. 9	1. 30	5. 50	178	2, 394, 000	872, 000
100,000 to 200,000 tons	20	23	2, 893, 999	9. 4	1. 15	5. 97	220	3, 683, 000	789, 000
200,000 to 500,000 tons	19	27	6, 203, 970	20. 2	1. 16	5. 90	246	7, 061, 000	857, 000
500,000 to 1,000,000 tons	10	28	12, 578, 349	40. 9	1. 28	6. 24	223	15, 879, 000	3, 301, 000
1,000,000 to 3,000,000 tons	1	3							
3,000,000 and over	1	11							
Total	179	237	25, 038, 571	81. 4	1. 24	5. 88	215	32, 272, 000	7, 234, 000
CONSUMER-OWNED									
10,000 to 50,000 tons	3	3	73, 256	. 2	1. 95	6. 46	199	103, 000	30, 000
50,000 to 100,000 tons	1	1	5, 650, 700	18. 4	1. 67	7. 52	239	6, 603, 000	951, 000
1,000,000 to 3,000,000 tons	1	2							
3,000,000 and over	1	4							
Total	6	10	5, 723, 956	18. 6	1. 67	7. 50	238	6, 706, 000	981, 000
Grand total	185	247	30, 762, 527	100. 0	1. 32	6. 12	218	38, 978, 000	8, 215, 000

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[c] Includes United States Coal Commission fields 9 (Central Pennsylvania) and 6 (Blossburg).

[d] Includes United States Coal Commission fields 11 (Fairmont), 24a (Coal and Coke), 24b (Preston County), and 24c (Taylor County, Junior-Philippi, and Gauley).

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

SOUTHERN WEST VIRGINIA—LOW VOLATILE [e]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	14	15	59,874	0.1	$1.86	3.37	72	233,000	173,000
10,000 to 50,000 tons	27	29	750,273	1.3	1.72	3.63	166	1,266,000	516,000
50,000 to 100,000 tons	25	28	1,830,052	3.3	1.72	4.18	216	2,372,000	542,000
100,000 to 200,000 tons	25	32	3,663,836	6.5	1.69	4.15	257	3,992,000	328,000
200,000 to 500,000 tons	43	69	13,907,065	24.7	1.70	4.84	260	14,977,000	1,070,000
500,000 to 1,000,000 tons	12	30	8,662,589	15.4	1.83	[f] 4.87	267	9,084,000	422,000
1,000,000 to 3,000,000 tons	7	34	17,781,658	31.5	1.74		283	17,561,000	−221,000
3,000,000 and over	2	26							
Total	155	263	46,655,347	82.8	1.74	[f] 4.77	263	49,485,000	2,830,000
CONSUMER-OWNED									
100,000 to 200,000 tons	2	4	1,723,521	3.0	2.02	4.17	256	1,911,000	188,000
200,000 to 500,000 tons	2	7							
500,000 to 1,000,000 tons	1	1							
1,000,000 to 3,000,000 tons	2	11	7,994,975	14.2	1.77	7.40	260	8,879,000	884,000
3,000,000 and over	1	8							
Total	8	31	9,718,496	17.2	1.81	6.51	259	10,790,000	1,072,000
Grand total	163	294	56,373,843	100.0	1.76	[f] 5.00	262	60,275,000	3,902,000

SOUTHERN WEST VIRGINIA—HIGH VOLATILE [g]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	20	20	71,677	0.1	$1.51	3.02	90	223,000	151,000
10,000 to 50,000 tons	15	16	546,612	1.2	1.34	3.75	161	951,000	405,000
50,000 to 100,000 tons	22	24	1,579,934	3.5	1.34	4.52	219	2,020,000	440,000
100,000 to 200,000 tons	26	30	3,663,342	8.1	1.41	4.61	249	4,119,000	456,000
200,000 to 500,000 tons	33	56	10,754,602	23.7	1.48	5.11	260	11,582,000	827,000
500,000 to 1,000,000 tons	9	25	6,840,624	15.1	1.37	6.71	258	7,424,000	583,000
1,000,000 to 3,000,000 tons	6	30	14,999,499	33.1	1.41		254	16,466,000	1,467,000
3,000,000 and over	1	10							
Total	132	211	38,456,290	84.8	1.42	5.76	249	42,785,000	4,329,000
CONSUMER-OWNED									
100,000 to 200,000 tons	1	1	1,993,571	4.4	1.76	5.64	220	2,535,000	541,000
200,000 to 500,000 tons	5	13							
500,000 to 1,000,000 tons	6	16	4,889,336	10.8	1.65	5.02	280	4,889,000	----------
Total	12	30	6,882,907	15.2	1.68	5.18	261	7,424,000	541,000
Grand total	144	241	45,339,197	100.0	1.46	5.67	251	50,209,000	4,870,000

EASTERN KENTUCKY

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	41	42	182,791	0.4	$1.83	2.62	93	550,000	368,000
10,000 to 50,000 tons	70	76	1,943,400	4.2	1.50	3.09	165	3,298,000	1,354,000
50,000 to 100,000 tons	49	53	3,556,000	7.7	1.48	3.86	213	4,675,000	1,119,000
100,000 to 200,000 tons	31	37	4,298,000	9.4	1.51	4.61	234	5,143,000	845,000
200,000 to 500,000 tons	35	51	10,855,000	23.6	1.60	4.82	244	12,457,000	1,602,000
500,000 to 1,000,000 tons	9	31	13,355,261	29.0	1.74	[h] 4.65	256	14,721,000	1,366,000
1,000,000 to 3,000,000 tons	2	17							
3,000,000 and over	1	16							
Total	238	323	34,190,452	74.3	1.62	[h] 4.45	231	40,844,000	6,654,000

[e] Includes United States Coal Commission fields 17 (Tug River), 18 (Pocahontas), 19 (Winding Gulf), and 20 (New River).

[f] In calculating the average tons per man per day, the 1930 experience of 2 companies was used as being more representative than that of 1929.

[g] Includes United States Coal Commission fields 21 (Kanawha), 22 (Coal River), 23 (Logan), 14 (Putnam County), and West Virginia portions of 13 (Mason County), 15 (Kenova), and 16 (Thacker).

[h] In calculating the tons per man per day the 1930 experience of 1 company was used as being more representative than that of 1929.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

EASTERN KENTUCKY—Continued

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
CONSUMER-OWNED									
10,000 to 50,000 tons	2	4	173,000	0.4	$1.46	3.61	224	228,000	55,000
50,000 to 100,000 tons	1	1							
200,000 to 500,000 tons	4	8	1,608,000	3.5	1.76	4.63	262	1,718,000	110,000
500,000 to 1,000,000 tons	4	5	2,480,000	5.4	1.79	5.03	246	2,823,000	343,000
1,000,000 to 3,000,000 tons	4	16	7,574,000	16.4	1.83	4.87	283	7,494,000	−80,000
Total	15	34	11,835,000	25.7	1.81	4.85	270	12,263,000	428,000
Grand total	253	357	46,025,452	100.0	1.67	[h] 4.55	239	53,107,000	7,082,000

VIRGINIA HIGH VOLATILE AND NORTH CAROLINA [i]

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	12	12	33,216	0.3	$2.12	2.39	119	78,000	45,000
10,000 to 50,000 tons	20	20	622,205	5.6	1.80	3.28	199	875,000	253,000
50,000 to 100,000 tons	8	11	540,228	4.9	1.97	2.83	200	783,000	243,000
100,000 to 200,000 tons	6	9	[j] 928,374	[j] 8.3	[j] 1.56	[j] 4.15	[j] 256	[j] 1,015,000	[j] 86,000
200,000 to 500,000 tons	4	11	1,294,358	11.7	1.62	4.35	228	1,590,000	296,000
500,000 to 1,000,000 tons	2	2	7,666,758	69.2	1.62	4.34	263	8,162,000	495,000
1,000,000 to 3,000,000 tons	2	14							
3,000,000 and over	1	8							
Total	55	87	11,085,139	100.0	1.64	4.13	246	12,503,000	1,418,000
CONSUMER-OWNED									
100,000 to 200,000 tons	1	1	([j])	([j])	([j])	([j])	([j])	([j])	([j])
Grand total	56	88	11,085,139	100.0	1.64	4.13	246	12,503,000	1,418,000

TENNESSEE

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	19	19	46,143	0.8	$1.94	2.01	92	140,000	94,000
10,000 to 50,000 tons	14	14	455,623	8.4	1.64	2.75	201	635,000	180,000
50,000 to 100,000 tons	14	22	1,142,044	21.1	1.77	3.15	212	1,508,000	366,000
100,000 to 200,000 tons	4	6	641,057	11.9	1.60	4.69	215	835,000	194,000
200,000 to 500,000 tons	7	11	2,046,707	37.9	1.61	3.49	271	2,115,000	68,000
Total	58	72	4,331,574	80.1	1.66	3.40	228	5,233,000	902,000
CONSUMER-OWNED									
Under 10,000 tons	1	1	179,993	3.4	2.07	2.66	156	320,000	140,000
50,000 to 100,000 tons	2	3							
100,000 to 200,000 tons	4	5	893,897	16.5	1.75	2.25	248	996,000	102,000
200,000 to 500,000 tons	1	2							
Total	8	11	1,073,890	19.9	1.80	2.31	229	1,316,000	242,000
Grand total	66	83	5,405,464	100.0	1.69	3.11	228	6,549,000	1,144,000

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[h] In calculating the tons per man per day the 1930 experience of 1 company was used as being more representative than that of 1929.

[i] Excludes portion of Pocahontas field in Tazewell County, Va.

[j] Operations of 1 captive company included under independent to avoid disclosing individual figures.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

ALABAMA AND GEORGIA

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	56	57	136, 550	0. 8	$2. 11	2. 03	122	313, 000	176, 000
10,000 to 50,000 tons	26	29	636, 392	3. 5	2. 16	2. 55	169	1, 054, 000	418, 000
50,000 to 100,000 tons	14	20	1, 123, 455	6. 2	2. 24	2. 51	208	1, 512, 000	389, 000
100,000 to 200,000 tons	9	15	1, 333, 917	7. 4	2. 57	2. 95	227	1, 645, 000	311, 000
200,000 to 500,000 tons	9	21	2, 692, 904	15. 0	2. 08	3. 23	222	3, 396, 000	703, 000
500,000 to 1,000,000 tons	2	16	4, 556, 677	25. 4	2. 03	3. 11	234	5, 437, 000	880, 000
1,000,000 to 3,000,000 tons	2	17							
Total	118	175	10, 479, 895	58. 3	2. 14	2. 98	217	13, 357, 000	2, 877, 000
CONSUMER-OWNED									
Under 10,000 tons	2	2	126, 386	0. 7	2. 30	2. 57	180	220, 000	94, 000
10,000 to 50,000 tons	4	4							
50,000 to 100,000 tons	1	1	905, 545	5. 0	2. 09	2. 91	224	1, 126, 000	220, 000
100,000 to 200,000 tons	1	1							
200,000 to 500,000 tons	2	4							
500,000 to 1,000,000 tons	2	2	6, 476, 733	36. 0	1. 98	3. 26	265	6, 856, 000	379, 000
1,000,000 to 3,000,000 tons	2	7							
3,000,000 and over	1	7							
Total	15	28	7, 508, 664	41. 7	2. 00	3. 20	257	8, 202, 000	693, 000
Grand total	133	203	17, 988, 559	100. 0	2. 08	3. 07	232	21, 559, 000	3, 570, 000
OHIO, WEST VIRGINIA PANHANDLE, AND MICHIGAN									
INDEPENDENT									
Under 10,000 tons	375	380	956, 590	3. 1	$1. 92	2. 95	141	1, 894, 000	938, 000
10,000 to 50,000 tons	98	104	2, 264, 975	7. 4	1. 61	4. 02	167	3, 816, 000	1, 551, 000
50,000 to 100,000 tons	23	25	1, 686, 642	5. 5	1. 70	4. 06	183	2, 589, 000	902, 000
100,000 to 200,000 tons	24	27	3, 369, 910	10. 9	1. 47	4. 69	216	4, 396, 000	1, 026, 000
200,000 to 500,000 tons	15	22	4, 236, 183	13. 7	1. 77	4. 82	228	5, 222, 000	986, 000
500,000 to 1,000,000 tons	12	32	7, 968, 756	25. 9	1. 46	4. 44	216	10, 261, 000	2, 292, 000
1,000,000 to 3,000,000 tons	4	14	4, 635, 649	15. 0	1. 39	4. 94	211	6, 172, 000	1, 536, 000
Total	551	604	25, 118, 705	81. 5	1. 55	4. 46	202	34, 350, 000	9, 231, 000
CONSUMER-OWNED									
Under 10,000 tons	20	22	105, 685	0. 3	2. 11	3. 04	235	127, 000	21, 000
10,000 to 50,000 tons	22	27	497, 318	1. 6	1. 96	3. 62	227	613, 000	116, 000
50,000 to 100,000 tons	3	9	190, 434	. 6	2. 07	3. 91	216	247, 000	57, 000
100,000 to 200,000 tons	3	5	446, 517	1. 5	2. 01	5. 45	244	521, 000	74, 000
200,000 to 500,000 tons	1	1	4, 470, 324	14. 5	1. 57	5. 64	255	4, 912, 000	442, 000
500,000 to 1,000,000 tons	2	2							
1,000,000 to 3,000,000 tons	2	9							
Total	53	75	5, 710, 278	18. 5	1. 67	5. 21	248	6, 420, 000	710, 000
Grand total	604	679	30, 828, 983	100. 0	1. 57	4. 58	208	40, 770, 000	9, 941, 000
INDIANA									
INDEPENDENT									
Under 10,000 tons	52	52	209, 826	1. 1	$1. 74	3. 46	107	549, 000	339, 000
10,000 to 50,000 tons	35	40	952, 587	5. 2	1. 52	4. 76	103	2, 590, 000	1, 637, 000
50,000 to 100,000 tons	8	9	560, 981	3. 0	1. 58	4. 74	116	1, 354, 000	793, 000
100,000 to 200,000 tons	14	15	1, 938, 322	10. 6	1. 58	7. 60	194	2, 798, 000	860, 000
200,000 to 500,000 tons	21	28	6, 907, 692	37. 7	1. 73	6. 11	193	10, 022, 000	3, 114, 000
500,000 to 1,000,000 tons	9	15	7, 169, 827	39. 1	1. 53	9. 77	196	10, 316, 000	3, 147, 000
1,000,000 to 3,000,000 tons	1	3							
Total	140	162	17, 739, 235	96. 7	1. 62	7. 10	173	27, 629, 000	9, 890, 000

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

INDIANA—Continued

Companies producing—	Number of companies	Number of mines	Actual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
CONSUMER-OWNED									
10,000 to 50,000 tons	1	1	605, 123	3. 3	$1. 98	5. 02	146	1, 059, 000	454, 000
50,000 to 100,000 tons	1	1							
100,000 to 200,000 tons	1	1							
200,000 to 500,000 tons	1	1							
Total	4	4	605, 123	3. 3	1. 98	5. 02	146	1, 059, 000	454, 000
Grand total	144	166	18, 344, 358	100. 0	1. 63	7. 00	172	28, 688, 000	10, 344, 000

ILLINOIS

INDEPENDENT									
Under 10,000 tons	295	298	784, 024	1. 3	$2. 36	2. 78	130	1, 689, 000	905, 000
10,000 to 50,000 tons	61	63	1, 470, 543	2. 4	2. 14	4. 07	125	3, 294, 000	1, 823, 000
50,000 to 100,000 tons	18	19	1, 195, 075	1. 9	1. 71	4. 89	117	2, 860, 000	1, 665, 000
100,000 to 200,000 tons	16	16	2, 413, 558	4. 0	1. 91	4. 89	177	3, 818, 000	1, 405, 000
200,000 to 500,000 tons	27	34	8, 665, 824	14. 3	1. 83	5. 79	182	13, 332, 000	4, 666, 000
500,000 to 1,000,000 tons	8	18	5, 879, 977	9. 7	1. 75	6. 93	201	8, 191, 000	2, 311, 000
1,000,000 to 3,000,000 tons	9	33	14, 193, 086	23. 4	1. 82	6. 61	191	20, 807, 000	6, 614, 000
3,000,000 and over	3	26	16, 552, 148	27. 3	1. 93	6. 35	174	26, 636, 000	10, 084, 000
Total	437	507	51, 154, 235	84. 3	1. 87	6. 03	174	80, 627, 000	29, 473, 000
CONSUMER-OWNED									
10,000 to 50,000 tons	1	2	170, 395	0. 3	2. 22	3. 10	248	205, 000	35, 000
50,000 to 100,000 tons	2	3							
100,000 to 200,000 tons	3	3	446, 789	. 7	2. 26	6. 28	218	574, 000	127, 000
200,000 to 500,000 tons	1	1	1, 713, 044	2. 9	1. 81	7. 60	195	2, 494, 000	781, 000
500,000 to 1,000,000 tons	2	2							
1,000,000 to 3,000,000 tons	2	6	7, 173, 178	11. 8	1. 88	6. 07	186	10, 730, 000	3, 557, 000
3,000,000 and over	1	4							
Total	12	21	9, 503, 406	15. 7	1. 89	6. 20	190	14, 003, 000	4, 500, 000
Grand total	449	528	60, 657, 641	100. 0	1. 87	6. 06	177	94, 630, 000	33, 973, 000

WESTERN KENTUCKY

INDEPENDENT									
Under 10,000 tons	22	22	83, 421	0. 6	$1. 33	3. 45	108	216, 000	133, 000
10,000 to 50,000 tons	35	37	858, 246	6. 0	1. 15	4. 37	118	2, 037, 000	1, 179, 000
50,000 to 100,000 tons	12	15	788, 850	5. 5	1. 10	5. 05	173	1, 277, 000	488, 000
100,000 to 200,000 tons	15	18	[k] 2, 097, 871	[k] 14. 5	[k] 1. 11	[k] 4. 43	[k] 196	[k] 3, 020, 000	[k] 922, 000
200,000 to 500,000 tons	13	19	3, 769, 000	26. 1	1. 16	5. 06	196	5, 384, 000	1, 615, 000
500,000 to 1,000,000 tons	6	19	6, 839, 760	47. 3	1. 13	5. 53	178	10, 776, 000	3, 936, 000
1,000,000 to 3,000,000 tons	1	13							
Total	104	143	14, 437, 148	100. 0	1. 14	5. 10	177	22, 710, 000	8, 273, 000
CONSUMER-OWNED									
100,000 to 200,000 tons	1	1	(k)	(k)	(k)	(k)	(k)	(k)	(k)
Grand total	105	144	14, 437, 148	100. 0	1. 14	5. 10	177	22, 710, 000	8, 273, 000

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[k] Operations of 1 captive company included under independent to avoid disclosing individual figures.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

IOWA, MISSOURI, AND KANSAS

Companies producing—	Number of companies	Number of mines	Actual production: Net tons	Actual production: Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	423	426	1, 144, 111	10. 2	$2. 77	2. 19	137	2, 382, 000	1, 238, 000
10,000 to 50,000 tons	99	105	2, 553, 834	22. 7	2. 57	2. 77	174	4, 182, 000	1, 628, 000
50,000 to 100,000 tons	18	23	1, 339, 963	11. 9	2. 45	3. 18	198	1, 923, 000	583, 000
100,000 to 200,000 tons	14	16	1, 952, 758	17. 3	2. 29	5. 50	197	2, 941, 000	988, 000
200,000 to 500,000 tons	9	16	2, 415, 401	21. 5	2. 59	4. 44	212	3, 330, 000	915, 000
Total	563	586	9, 406, 067	83. 6	2. 52	3. 41	177	14, 758, 000	5, 352, 000
CONSUMER-OWNED									
10,000 to 50,000 tons	1	1	317, 722	2. 8	2. 46	3. 36	230	388, 000	70, 000
100,000 to 200,000 tons	2	2							
200,000 to 500,000 tons	2	5	1, 523, 562	13. 6	2. 56	3. 55	209	2, 045, 000	522, 000
500,000 to 1,000,000 tons	1	4							
Total	6	12	1, 841, 284	16. 4	2. 54	3. 52	212	2, 433, 000	592, 000
Grand total	569	598	11, 247, 351	100. 0	2. 53	3. 42	182	17, 191, 000	5, 944, 000

OKLAHOMA, ARKANSAS, AND TEXAS

Companies producing—	Number of companies	Number of mines	Actual production: Net tons	Actual production: Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	75	76	296, 232	4. 5	$3. 11	2. 70	101	813, 000	517, 000
10,000 to 50,000 tons	81	94	1, 906, 725	29. 0	3. 07	2. 42	160	3, 431, 000	1, 524, 000
50,000 to 100,000 tons	24	31	1, 761, 123	26. 8	2. 81	3. 38	179	2, 777, 000	1, 016, 000
100,000 to 200,000 tons	4	17	535, 025	8. 2	3. 11	3. 73	177	877, 000	342, 000
200,000 to 500,000 tons	3	5	854, 051	13. 0	1. 46	8. 63	238	991, 000	137, 000
Total	187	223	5, 353, 156	81. 5	2. 73	3. 23	164	8, 889, 000	3, 536, 000
CONSUMER-OWNED									
10,000 to 50,000 tons	2	2	369, 983	5. 6	2. 52	3. 25	143	753, 000	383, 000
50,000 to 100,000 tons	4	5							
100,000 to 200,000 tons	1	2	846, 717	12. 9	3. 70	3. 28	258	918, 000	71, 000
200,000 to 500,000 tons	1	3							
Total	8	12	1, 216, 700	18. 5	3. 34	3. 27	207	1, 671, 000	454, 000
Grand total	195	235	6, 569, 856	100. 0	2. 85	3. 23	170	10, 560, 000	3, 990, 000

SOUTHERN ROCKY MOUNTAIN FIELDS[1]

Companies producing—	Number of companies	Number of mines	Actual production: Net tons	Actual production: Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	145	150	397, 894	2. 2	$2. 84	2. 66	160	701, 000	303, 000
10,000 to 50,000 tons	31	33	775, 310	4. 4	2. 80	3. 68	189	1, 149, 000	374, 000
50,000 to 100,000 tons	26	27	1, 870, 572	10. 6	2. 67	4. 27	187	2, 808, 000	937, 000
100,000 to 200,000 tons	14	21	1, 911, 939	10. 8	2. 85	3. 73	212	2, 572, 000	660, 000
200,000 to 500,000 tons	11	18	3, 373, 159	19. 0	2. 41	6. 20	197	4, 791, 000	1, 418, 000
500,000 to 1,000,000 tons	4	17	2, 869, 244	16. 2	2. 68	5. 45	200	4, 061, 000	1, 192, 000
Total	231	266	11, 198, 118	63. 2	2. 64	4. 70	195	16, 082, 000	4, 884, 000
CONSUMER-OWNED									
10,000 to 50,000 tons	1	1	266, 642	1. 5	2. 28	7. 14	176	504, 000	237, 000
50,000 to 100,000 tons	1	1							
100,000 to 200,000 tons	1	1							
200,000 to 500,000 tons	3	5	956, 868	5. 4	2. 98	5. 64	262	1, 002, 000	45, 000
500,000 to 1,000,000 tons	4	17	5, 292, 998	29. 9	2. 70	4. 83	191	7, 761, 000	2, 468, 000
1,000,000 to 3,000,000 tons	1	14							
Total	11	39	6, 516, 508	36. 8	2. 73	5. 00	197	9, 267, 000	2, 750, 000
Grand total	242	305	17, 714, 626	100. 0	2. 67	4. 81	196	25, 349, 000	7, 634, 000

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[1] Includes Colorado, New Mexico, Utah, and the small outlying fields of Arizona, Nevada, and California.

TABLE 27.—*Bituminous coal-mining operations in 19 major fields, in 1929, classified by size of producing company*—Continued

NORTHERN ROCKY MOUNTAIN AND GREAT PLAINS [m]

Companies producing—	Number of companies	Number of mines	Annual production		Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
			Net tons	Per cent					
INDEPENDENT									
Under 10,000 tons	210	210	411,778	3.4	$2.25	3.08	159	721,000	309,000
10,000 to 50,000 tons	17	18	321,921	2.7	2.25	4.19	147	617,000	295,000
50,000 to 100,000 tons	9	9	652,043	5.4	2.34	5.25	183	1,016,000	364,000
100,000 to 200,000 tons	6	9	920,194	7.7	2.36	6.61	210	1,253,000	333,000
200,000 to 500,000 tons	8	13	3,745,088	31.3	2.32	7.59	204	5,289,000	1,544,000
500,000 to 1,000,000 tons	2	4							
Total	252	263	6,051,024	50.5	2.32	6.26	189	8,896,000	2,845,000
CONSUMER-OWNED									
Under 10,000 tons	2	2	81,118	0.7	2.31	5.89	189	122,000	41,000
10,000 to 50,000 tons	2	2							
100,000 to 200,000 tons	2	3	691,899	5.7	2.78	5.31	202	969,000	277,000
200,000 to 500,000 tons	1	2							
500,000 to 1,000,000 tons	1	1	5,167,459	43.1	2.26	7.26	258	5,710,000	543,000
1,000,000 to 3,000,000 tons	1	3							
3,000,000 and over	1	12							
Total	10	25	5,940,476	49.5	2.32	6.94	246	6,801,000	861,000
Grand total	262	288	11,991,500	100.0	2.32	6.58	212	15,697,000	3,706,000

WASHINGTON AND ALASKA [n]

Companies producing—	Number of companies	Number of mines	Net tons	Per cent	Average sales realization	Average tons per man per day	Average days worked	Potential production if mines worked 280 days	Excess of potential over actual production
INDEPENDENT									
Under 10,000 tons	31	31	102,855	3.9	$2.96	2.36	176	155,000	52,000
10,000 to 50,000 tons	7	8	183,147	7.0	3.72	3.30	219	236,000	53,000
50,000 to 100,000 tons	2	3	1,132,214	43.1	3.86	3.35	249	1,285,000	153,000
100,000 to 200,000 tons	2	4							
200,000 to 500,000 tons	1	1							
500,000 to 1,000,000 tons	1	3							
Total	44	50	1,418,216	54.0	3.77	3.24	235	1,676,000	258,000
CONSUMER-OWNED									
10,000 to 50,000 tons	1	1	1,209,380	46.0	3.18	4.62	210	1,622,000	413,000
200,000 to 500,000 tons	1	1							
500,000 to 1,000,000 tons	1	4							
Total	3	6	1,209,380	46.0	3.18	4.62	210	1,622,000	413,000
Grand total	47	56	2,627,596	100.0	3.50	3.76	225	3,298,000	671,000

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[m] Includes Wyoming, Montana, North Dakota, and South Dakota.
[n] Includes also the small outlying field of Oregon.

VALUE AND PRICES

DEFINITION OF VALUES REPORTED

The value given in this report is the amount received at the mines f. o. b. cars minus the selling expense, and the average value per ton is the average amount received, obtained by dividing the total value by the number of tons sold or produced Coal used at the mines, coal coked by the producing company, and coal used in some other industry by that company—in all, forming a considerable part of the total output—is not sold, and the value placed upon it is either an estimate or the amount at which it is carried on the company's books. Either value is presumably the amount the coal would have brought if it had been sold or the amount other fuel for the purpose stated would have cost if it had been purchased. In other words, the values given represent returns to the operators for coal sold plus the estimated value of that not sold. The value thus fixed is more or less arbitrary and does not necessarily represent the current prices for coal sold commercially. Many mines are owned by consumers who take all or a great part of their output at nominal prices. The output of such "captive mines" was 22.7 per cent of the entire production in 1926. (Coal in 1926, pp. 473–475.) In 1929 the average value reported by "captive" companies was $1.99 a ton, or considerbly more than that reported by the commercial companies, which was $1.72. (See Table 26.) Even where the coal is actually sold large quantities may be moved on "cost plus" contracts that provide for prices below the average spot prices in the field or the average prices received for coal delivered under ordinary contracts. The figures in the following tables, therefore, do not necessarily show prices on the commercial market or even an average of the prices at the mines. Taken over a period of years, however, they do furnish a faithful index to the rise and fall in the value of coal.

The computed "average value per ton" is thus affected by the value placed by the operator upon coal used at the mine but not shipped. In order to ascertain how large an influence the inclusion of this noncommercial coal might have upon the average, the operators were requested for several years to give separate statements of value for coal loaded at the mines for shipment, for sales to local trade, and for mine fuel and coal made into beehive coke. It was found, however, that for practical purposes the average value of all the coal produced may be accepted as a measure of the average value of the coal shipped. The values placed by operators on mine fuel and upon the coal coked were generally somewhat less than the average amounts received for the coal shipped, but the quantities to which these lower values applied were so much smaller than the quantity shipped that their effect upon the average for all coal was negligible. (Coal in 1922, p. 546.)

ESTIMATES OF VALUE INCLUDED IN STATISTICS

If an operator who is known to have produced coal during the year makes no report of the value of his product to the Bureau of Mines, an estimate of the value is included in the total to make it complete. These estimates are based on the average for each county as obtained from all reports of the operators in the county that did specify value.

Of the $952,781,000 given as the total value of bituminous coal at the mines in 1929, fully $913,215,000 represents actual reports from the operators and $39,566,000 represents estimates made in the manner just described. The proportion actually reported is thus 95.9 per cent of the total, a proportion so high as to indicate that the results are thoroughly representative for the country as a whole. The percentage actually reported in each of the principal States is shown in Table 28.

TABLE 28.—*Per cent of total value of bituminous coal produced by commercial operators that is represented by actual reports from the operators, by States, in 1929*

State	Per cent	State	Per cent
Alabama	75.78	North Dakota	98.92
Arkansas	78.91	Ohio	97.59
Colorado	96.23	Oklahoma	72.18
Illinois	94.42	Pennsylvania	98.19
Indiana	96.20	Tennessee	99.91
Iowa	79.12	Texas	98.44
Kansas	88.28	Utah	98.69
Kentucky	94.84	Virginia	98.92
Maryland	95.50	Washington	98.76
Michigan	98.69	West Virginia	98.59
Missouri	99.62	Wyoming	99.85
Montana	98.35		
New Mexico	99.86	United States	95.85

TABLE 29.—*Total and average value per net ton of coal at mines, by States, 1923 and 1929*

State	Total			Average per net ton		
	1923	1929	Increase or decrease	1923	1929	Increase or decrease
Alabama	$51,624,000	$37,309,000	−$14,315,000	$2.52	$2.08	−$0.44
Alaska	755,000	528,000	−227,000	6.30	5.25	−1.05
Arizona		44,000			4.34	
Arkansas	5,192,000	5,624,000	+432,000	4.01	3.32	−.69
California, Idaho, and Oregon	79,000	[1]37,000	−42,000	3.94	3.58	−.36
Colorado	33,299,000	26,254,000	−7,045,000	3.22	2.65	−.57
Georgia	327,000	136,000	−191,000	4.32	3.05	−1.27
Illinois	198,388,000	113,453,000	−84,935,000	2.50	1.87	−.63
Indiana	65,046,000	29,880,000	−35,166,000	2.48	1.63	−.85
Iowa	20,517,000	11,948,000	−8,569,000	3.59	2.82	−.77
Kansas	14,275,000	6,697,000	−7,578,000	3.21	2.25	−.96
Kentucky	113,542,000	93,283,000	−20,259,000	2.54	1.54	−1.00
Maryland	6,911,000	4,640,000	−2,271,000	3.02	1.75	−1.27
Michigan	5,545,000	2,904,000	−2,641,000	4.73	3.61	−1.12
Missouri	11,575,000	9,778,000	−1,797,000	3.40	2.43	−.97
Montana	9,652,000	7,561,000	−2,091,000	3.07	2.22	−.85
New Mexico	10,668,000	8,314,000	−2,354,000	3.66	3.17	−.49
North Carolina	132,000	177,000	+45,000	3.66	3.39	−.27
North Dakota	3,275,000	3,157,000	−118,000	2.36	1.70	−.66
Ohio	98,610,000	35,733,000	−62,877,000	2.43	1.51	−.92
Oklahoma	10,874,000	11,481,000	+607,000	3.77	3.04	−.73
Pennsylvania bituminous	472,217,000	258,607,000	−213,610,000	2.75	1.80	−.95
South Dakota	25,000	38,000	+13,000	2.41	2.96	+.55
Tennessee	16,515,000	9,122,000	−7,393,000	2.73	1.69	−1.04
Texas	2,162,000	1,600,000	−562,000	1.82	1.45	−.37
Utah	13,657,000	12,725,000	−932,000	2.89	2.47	−.42
Virginia	32,468,000	20,942,000	−11,526,000	2.76	1.64	−1.12
Washington	10,894,000	8,647,000	−2,247,000	3.72	3.43	−.29
West Virginia	285,481,000	215,110,000	−70,371,000	2.65	1.55	−1.10
Wyoming	20,916,000	17,052,000	−3,864,000	2.76	2.54	−.22
Total bituminous	1,514,621,000	952,781,000	−561,840,000	2.68	1.78	−.90
Pennsylvania anthracite	506,787,000	385,643,000	−121,144,000	5.43	5.22	−.21
Grand total	2,021,408,000	1,338,424,000	−682,984,000	3.07	2.20	−.87

[1] Includes Nevada.

AVERAGE VALUE PER TON

Changes in the average value of coal per net ton from 1880 to 1929 are shown in Table 30. It is noteworthy that the downward trend in sales realizations on bituminous coal, apparent since 1923, continued in 1929. In the latter year the average value per ton was $1.78, the lowest realization since 1916. The decline in the grand average reflected reductions in comparison with the preceding year in all but six States. (See Table 31.)

The figures of average value collected by the Bureau of Mines are a composite of business covered by contract or trade connections of long standing at stable prices and business on the open market, termed by the trade "spot sales." The spot price reflects the momentary condition of the market as interpreted by the buyer seeking low prices on the one hand and by the seller attempting to place his coal at the maximum profit on the other. Much significance, therefore, attaches to the course of spot prices as an index to the state of trade. (See Table 34 and Figure 39.) As indicated in Table 33, however, the spot price should not be taken as a measure of sales realization by the coal producer over any extended period.

TABLE 30.—*Average value per net ton of coal at mines, 1880–1929*

Year	Anthracite [1]	Bituminous	Year	Anthracite [1]	Bituminous	Year	Anthracite [1]	Bituminous
1880	$1.47	$1.25	1897	$1.51	$0.81	1914	$2.07	$1.17
1881	2.01	1.12	1898	1.41	.80	1915	2.07	1.13
1882	2.01	1.12	1899	1.46	.87	1916	2.30	1.32
1883	2.01	1.07	1900	1.49	1.04	1917	2.85	2.26
1884	1.79	.94	1901	1.67	1.05	1918	3.40	2.58
1885	2.00	1.13	1902	1.84	1.12	1919	4.14	2.49
1886	1.95	1.05	1903	2.04	1.24	1920	4.85	3.75
1887	2.01	1.11	1904	1.90	1.10	1921	5.00	2.89
1888	1.91	1.00	1905	1.83	1.06	1922	5.01	3.02
1889	1.44	.99	1906	1.85	1.11	1923	5.43	2.68
1890	1.43	.99	1907	1.91	1.14	1924	5.43	2.20
1891	1.46	.99	1908	1.90	1.12	1925	5.30	2.04
1892	1.57	.99	1909	1.84	1.07	1926	5.62	2.06
1893	1.59	.96	1910	1.90	1.12	1927	5.26	1.99
1894	1.51	.91	1911	1.94	1.11	1928	5.22	1.86
1895	1.41	.86	1912	2.11	1.15	1929	5.22	1.78
1896	1.50	.83	1913	2.13	1.18			

[1] Averages for anthracite represent amounts per net ton and include all coal produced.

TABLE 31.—*Average value per net ton of coal at mines, by States, 1913, 1917, 1920, and 1923–1929*

State	1913	1917	1920	1923	1924	1925	1926	1927	1928	1929	
										Average	Increase or decrease from 1928
Alabama	$1.31	$2.27	$3.65	$2.52	$2.34	$2.12	$2.29	$2.25	$2.25	$2.08	−$0.17
Alaska	(1)	4.92	5.83	6.30	5.62	4.89	5.26	5.25	5.25	5.25	------
Arkansas	1.76	2.56	4.56	4.01	4.06	3.96	3.77	3.48	3.38	3.32	−.06
California [1]	3.45	2.30	4.36	3.94	4.19	4.75	3.67	2.81	3.13	3.96	+.83
Colorado	1.52	2.22	3.49	3.22	3.05	2.94	2.78	2.78	2.80	2.65	−.15
Georgia	1.41	2.53	5.00	4.32	3.62	3.32	2.89	3.04	3.10	3.05	−.05
Illinois	1.14	1.88	3.08	2.50	2.27	2.19	2.14	2.16	2.00	1.87	−.13
Indiana	1.11	1.99	3.16	2.48	2.16	2.02	1.98	2.03	1.78	1.63	−.15
Iowa	1.79	2.35	3.94	3.59	3.31	3.14	3.07	3.15	2.86	2.82	−.04
Kansas	1.67	2.31	3.87	3.21	3.03	2.88	2.84	2.80	2.44	2.25	−.19
Kentucky	1.05	2.17	4.11	2.54	1.88	1.72	1.74	1.73	1.56	1.54	−.02
Maryland	1.24	2.46	4.63	3.02	2.17	1.97	2.21	2.07	1.84	1.75	−.09
Michigan	1.99	3.22	4.93	4.73	4.33	4 20	4.12	4.31	4.26	3.61	−.65
Missouri	1.73	2.43	4.16	3.40	3.29	3.07	2.98	2.84	2.58	2.43	−.15
Montana	1.74	2.11	3.16	3.07	2.96	2.59	2.46	2.35	2.27	2.22	−.05
New Mexico	1.46	1.86	3.68	3.66	3.51	3.37	3.16	3.13	3.18	3.17	−.01
North Carolina	------	------	7.02	3.66	3.92	4.34	4.19	3.58	3.30	3.39	+.09
North Dakota	1.52	1.80	2.87	2.36	2.06	1.85	1.74	1.70	1.68	1.70	+.02
Ohio	1.10	2.48	3.82	2.43	2.03	1.93	1.96	1.92	1.69	1.51	−.18
Oklahoma	2.05	2.81	4.80	3.77	3.69	3.30	3.18	3.03	2.96	3.04	+.08
Oregon	2.53	3.38	4.49	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Pennsylvania bituminous	1.11	2.44	3.77	2.75	2.26	2.10	2.13	2.05	1.90	1.80	−.10
South Dakota	1.96	2.90	3.60	2.41	2.99	2.91	2.91	3.04	2.80	2.96	+.16
Tennessee	1.14	2.19	4.02	2.73	2.13	1.85	1.90	1.84	1.73	1.69	−.04
Texas	1.77	1.77	3.75	1.82	1.50	1.55	1.60	1.51	1.34	1.45	+.11
Utah	1.65	2.07	3.22	2.89	2.69	2.56	2.37	2.32	2.53	2.47	−.06
Virginia	1.01	2.00	3.99	2.76	2.04	1.84	1.92	1.80	1.71	1.64	−.07
Washington	2.38	2.68	3.88	3.72	3.65	3.62	3.61	3.50	3.46	3.43	−.03
West Virginia	1.01	2.32	4.34	2.65	1.82	1.71	1.84	1.72	1.59	1.55	−.04
Wyoming	1.56	1.93	2.98	2.76	2.71	2.79	2.74	2.69	2.64	2.54	−.10
Total bituminous	1.18	2.26	3.75	2.68	2.20	2.04	2.06	1.99	1.86	1.78	−.08
Pennsylvania anthracite [2]	2.13	2.85	4.85	5.43	5.43	5.30	5.62	5.26	5.22	5.22	------

[1] California includes Alaska, 1913; Arizona, 1926–1929; Idaho, 1913–1929; Nebraska, 1924; Nevada, 1927 and 1929; and Oregon, 1923–1929.

[2] These values represent amounts per net ton and include all coal produced.

AVERAGE EXPORT PRICES

TABLE 32.—*Average value per net ton of bituminous coal exported from the United States to Canada and to all other destinations, by months, 1924–1929*

[Computed from records of Bureau of Foreign and Domestic Commerce. Figures represent value at port, including transportation, and are therefore affected by changes in freight rates as well as f. o. b. mine prices. They include, of course, both spot and contract shipments. Data for 1902 to 1923 were published in Coal in 1923, pp. 624–625]

Month	1924		1925		1926		1927		1928		1929	
	Canada	All other	Canada	All other	Canada	All other	Canada	All other	Canada	All other	Canada	All other
January	$4.73	$4.55	$4.31	$4.13	$3.72	$4.42	$4.37	$5.34	$3.84	$4.45	$3.85	$4.33
February	4.64	4.49	4.42	4.25	3.84	4.28	4.17	4.52	3.87	4.21	3.75	4.35
March	4.52	4.45	3.98	4.18	3.75	4.16	4.17	4.45	3.81	4.35	3.84	4.30
April	4.40	4.41	3.98	4.11	4.00	4.26	3.89	4.37	3.96	4.37	4.00	4.15
May	4.01	4.47	3.72	4.06	3.74	4.25	3.63	4.36	3.63	4.33	3.79	4.23
June	3.66	4.46	3.85	4.10	3.73	4.28	3.61	4.26	3.56	4.14	3.51	4.05
July	3.68	4.48	3.77	4.06	3.81	4.35	3.62	4.21	3.52	4.15	3.62	3.77
August	3.83	4.37	3.84	4.08	3.85	4.37	3.59	4.22	3.45	4.11	3.75	4.10
September	3.76	4.19	3.61	4.28	3.70	4.49	3.70	4.27	3.47	4.12	3.56	4.04
October	3.91	4.24	3.72	4.23	3.76	4.71	3.62	4.29	3.42	4.31	3.67	4.20
November	4.17	4.32	3.79	4.25	3.90	5.47	3.69	4.34	3.48	4.21	3.67	4.06
December	4.16	4.27	3.77	4.38	4.10	5.51	4.01	4.29	3.81	4.06	3.84	4.16
Average	4.06	4.40	3.84	4.16	3.83	4.79	3.81	4.60	3.59	4.23	3.70	4.14

SPOT PRICES

TABLE 33.—*Average spot price and average amount received per ton for bituminous coal, 1906–1929*

Year	Coal Age's average spot price	Average amount received	Difference [1]	Year	Coal Age's average spot price	Average amount received	Difference
1906	$1.21	$1.11	+$0.10	1919	$2.59	$2.49	+$0.10
1907	1.18	1.14	+.04	1920	5.64	3.75	+1.89
1908	1.05	1.12	−.07	1921	2.55	2.89	−.34
1909	1.04	1.07	−.03	1922	3.64	3.02	+.62
1910	1.23	1.12	+.11	1923	2.77	2.68	+.09
1911	1.07	1.11	−.04	1924	2.08	2.20	−.12
1912	1.21	1.15	+.06	1925	2.06	2.04	+.02
1913	1.23	1.18	+.05	1926	2.21	2.06	+.15
1914	1.14	1.17	−.03	1927	1.99	1.99	----------
1915	1.12	1.13	−.01	1928	1.80	1.86	−.06
1916	1.85	1.32	+.53	1929	1.79	1.78	+.01
1917	3.25	2.26	+.99				
1918	2.58	2.58	----------	Average 24 years	2.01	1.84	+.17

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[1] A plus sign indicates that the spot price was greater than the average amount received, and a minus sign indicates that it was less than the average amount received.

TABLE 34.—*Monthly average spot price of bituminous coal f. o. b. mines, 1910–1929, as published by Coal Age*

[Figures are average of trade-journal quotations on 14 coals representative of nearly 90 per cent of the bituminous output of the United States, weighted, first, with respect to the proportions each of slack, prepared, and run-of-mine normally shipped, and, second, with respect to the tonnage of each normally produced. For 1919 to 1929 the figures are those published currently by Coal Age, based upon the reports of its field correspondents. For 1913 to 1918 they are taken from Prices of Coal and Coke, by C. E. Lesher, published in 1919 as a chapter of Mineral Resources of the United States, 1918, and also separately by the Fuel Administration and the War Industries Board, modified slightly, however, to permit comparison with the postwar quotations. For 1910 to 1912 they are taken from a study by F. G. Tryon and W. F. McKenney, compiled in as nearly the same way as the trade-journal quotations available permit and representing 12 or 14 coals covered by the later series. Data for 1906 to 1909 will be found in Coal in 1923, p. 621]

Month	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
January	$1.24	$1.16	$1.14	$1.46	$1.21	$1.13	$1.53	$4.15	$2.48	$2.57
February	1.23	1.11	1.22	1.22	1.16	1.12	1.40	4.18	2.53	2.49
March	1.25	1.08	1.64	1.17	1.17	1.09	1.27	3.89	2.58	2.47
April	1.26	1.06	1.30	1.17	1.16	1.08	1.24	3.21	2.64	2.43
May	1.19	1.05	1.11	1.15	1.16	1.07	1.21	4.14	2.67	2.38
June	1.18	1.05	1.09	1.14	1.12	1.07	1.26	4.00	2.57	2.40
July	1.18	1.03	1.04	1.18	1.12	1.05	1.22	3.17	2.58	2.47
August	1.20	1.02	1.05	1.22	1.13	1.07	1.30	3.24	2.58	2.76
September	1.32	1.03	1.09	1.23	1.11	1.10	1.57	2.02	2.58	2.91
October	1.27	1.04	1.21	1.29	1.13	1.12	2.26	2.02	2.58	3.09
November	1.23	1.09	1.30	1.31	1.10	1.17	3.87	2.48	2.58	2.57
December	1.22	1.09	1.29	1.26	1.11	1.33	4.01	2.48	2.58	2.58
Average	1.23	1.07	1.21	1.23	1.14	1.12	1.85	3.25	2.58	2.59

Month	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
January	$2.57	$3.26	$2.25	$4.38	$2.21	$2.10	$2.18	$2.34	$1.85	$1.85
February	2.58	2.77	2.20	3.59	2.25	2.04	2.09	2.11	1.86	1.86
March	2.58	2.63	2.12	3.20	2.15	1.99	2.01	2.06	1.91	1.78
April	3.85	2.62	2.24	2.84	2.07	1.95	1.92	1.93	1.74	1.69
May	4.59	2.68	3.11	2.68	2.04	1.97	1.93	1.87	1.73	1.68
June	7.18	2.52	3.31	2.56	2.03	1.95	1.90	1.85	1.73	1.67
July	8.24	2.40	4.67	2.40	1.98	1.93	1.91	1.87	1.71	1.70
August	9.51	2.42	6.13	2.39	1.99	2.04	2.00	2.06	1.74	1.77
September	8.52	2.37	5.08	2.46	2.02	2.18	2.15	2.07	1.81	1.83
October	7.78	2.33	4.48	2.28	2.10	2.13	2.70	1.96	1.83	1.90
November	5.87	2.35	4.11	2.25	2.06	2.26	3.19	1.90	1.85	1.88
December	4.38	2.26	4.05	2.18	2.06	2.19	2.53	1.90	1.85	1.87
Average	5.64	2.55	3.64	2.77	2.08	2.06	2.21	1.99	1.80	1.79

LABOR STATISTICS

MEN EMPLOYED

The statistics of number of men employed presented in this report (see Tables 35–37) are based on replies of operators to the following questions:

Average number of men employed during year:
  Underground—
    Miners (hand or machine, including cutters, loaders, shot firers, and all others working at the "face")__________
    Haulage and track employees__________
    All other underground workers__________
  Surface (excluding coke and office workers)__________
    Total number employed__________

Measuring the number of employees in coal mining presents certain difficulties not met in manufacturing establishments. The coal industry is accustomed to intermittent operation and adjusts itself to fluctuations in demand, not by cutting down the number of men on the pay roll as much as by working fewer days. The mine has a normal working force which under ordinary conditions is employed whenever it operates. The factor of irregularity of operation—

which, of course, has a profound influence on the amount of employment offered—can best be measured by the number of days worked by the mine as a whole. (See Table 38.) The objective in measuring the number of workers is to ascertain the typical working force of the mine while in operation.

The ideal basis of calculating the average number of employees would be either a record of the actual attendance from day to day or a record of the number of man-shifts worked, the latter to be considered in relation to the number of days worked by the mine itself. Very few American companies, however, keep such records. The attendance and time worked by the day workers—that is, the men paid by the day—can be ascertained from the mine pay roll; for the much larger number of tonnage workers, however—the men paid by the piece—records of either attendance or time worked are seldom available. At most mines no record is kept of the hours spent underground by the tonnage men, and the only evidence that an individual pick miner or loader had worked at all on a given day would be the presence of his check number on the weigh sheet or possibly an entry in the foreman's attendance book. The lack of such a statement of the attendance and time worked by the tonnage men is a serious handicap to the collection of accurate statistics of earnings, accident rates, volume of employment, attendance, and productivity of labor and efficiency of management. The difficulties in the way of keeping such a record are not insuperable, as is shown by the fact that it is a regular feature of the records of the industry in Great Britain and in some of the Canadian districts. The installation of such a record, developed on a plan that can be applied under American conditions of mining, is urged upon both employers and employees. Until it can be provided, measurements of all factors that involve the amount of labor expended will remain crude and subject to serious error.

At the great majority of American coal mines the only practicable basis for determining the number employed is the number of names on the pay roll. This figure, of course, is slightly greater than the number actually at work from day to day because it includes the men who are absent for any reason, whether voluntary or beyond their control. The number on the pay roll also involves a small element of double counting to the extent that a man moving from one mine to another and appearing on the pay rolls of both in the same pay period would be counted twice; in other words, a duplication is introduced in proportion to the rapidity of labor turnover. Important as turnover may be to studies of labor relations and labor efficiency it does not appear that the duplication introduced by it seriously impairs the value of the figures of numbers employed, for at the maximum the degree of inflation can only be one-twenty-fourth of the total turnover during the year, and even at a mine with an annual turnover of 100 per cent the inflations on a single pay roll could hardly be more than 4 per cent. Some of the smaller operators simply report the number of men on a recent typical pay roll. A better way is to average the active pay rolls for the year. In calculating the average, however, only those pay periods should be used in which the mine was producing coal. Pay periods should not be included in which, because of a strike or of idleness through lack of market, the number of men drawing pay is only a small fraction of the normal working force. To include such a pay period would artificially cut down the average number of men in the working crew of the mine, and it is clear from the returns that operators do not include such periods in calculating the average.

In this connection it is important to note a difference between the statistics published by the Bureau of Mines and those in the decennial Census of Mines and Quarries. The Bureau of Mines figure represents a typical pay roll when the mine is in operation. The census figure is an average of the men actually drawing pay on the fifteenth of each month. Thus, a mine employing 200 men and operating in January, February, and March, shutting down for the next six months, and operating again in October, November, and December, would be represented in the Bureau of Mines report by 200 men and in the census returns by only 100. To cite an extreme example, the Census of Mines and Quarries of 1919 gives the "average number of wage earners employed during the year" at coal mines in Illinois as 73,870, but this average is depressed by including November, in which month the number on the pay roll was only 11,000 because of the general strike. On January 15, according to the census, the number on the roll was 84,197, and this agrees closely with the Bureau of Mines figure of 85,020 men employed.

The records of the Bureau of Mines therefore give the normal working force when the mine is operating, and they include all mines that may have operated at any time, however short, during the year. Thus, a mine with 200 men which worked during January, February, and March in 1928 and was then abandoned would be represented in the 1928 total by 200 men and in the total for 1929 would not appear at all. In other words the figures represent the number of men ordinarily reporting for work when the mine starts, plus the absentees—the men who have been working recently and will work again, but who for one reason or another are not on hand that day. The totals for districts in the United States represent the number of men who drew pay from the mines during the year. They give a fair measure of the total number of coal-mine workers now employed in the industry. These statistics are not accurate in all details, but they are comparable from year to year and represent the most accurate returns obtainable under present conditions both as to the records generally available in mine offices and as to the funds allotted to the Bureau of Mines for collecting data.

The number employed at bituminous-coal mines reached a maximum in 1923, when 705,000 men were reported. Each succeeding year has seen a reduction. In 1928 the number fell to 522,000, and a further decrease carried it to 503,000 in 1929. Thus, in the six years since 1923, 202,000 men in all have been forced out of the bituminous mines, a decrease of 28.6 per cent. As Table 35 shows, the reduction has affected every State but one, although it has been far more drastic in the unionized fields of the North than in the South. The change since 1928 has been less uniform; although the total for the bituminous industry shows a decline of 3.7 per cent, a number of States reported a small increase.

In the anthracite region the change in number of employees has been less pronounced. For some years after 1923 the number employed increased, but in the last two years it has been reduced 4.1 per cent below the level of 1923.

TABLE 35.—*Comparative number of employees in coal mines, by States, 1923, 1927, 1928, and 1929*

State	Average number employed				Per cent of increase or decrease		
	1923	1927	1928	1929	1923–1929	1927–1929	1928–29
Alabama	30,035	27,615	25,708	25,208	−16.1	−8.7	−1.9
Arkansas	3,754	3,706	4,092	4,299	+14.5	+16.0	+5.1
Colorado	13,340	11,999	12,366	12,057	−9.6	+.5	−2.5
Illinois	99,714	76,970	64,266	56,725	−43.1	−26.3	−11.7
Indiana	35,408	24,352	16,806	15,250	−56.9	−37.4	−9.3
Iowa	11,448	8,741	6,965	7,295	−36.3	−16.5	+4.7
Kansas	9,761	7,004	5.991	5,139	−47.4	−26.6	−14.2
Kentucky	60,811	64,747	62,195	58,649	−3.6	−9.4	−5.7
Maryland	3,725	3,459	3,304	3,289	−11.7	−4.9	−.5
Michigan	1,977	1,512	1,239	1,336	−32.4	−11.6	+7.8
Missouri	6,952	6,232	5,964	5,618	−19.2	−9.9	−5.8
Montana	3,511	2,281	2,191	2,283	−35.0	+.1	+4.2
New Mexico	4,095	3,456	3,441	3,233	−21.1	−6.5	−6.0
North Dakota	1,621	1,341	1,335	1,421	−12.3	+6.0	+6.4
Ohio	54,555	35,543	21,371	25,399	−53.4	−28.5	+18.8
Oklahoma	7,130	5,796	6,218	6,321	−11.3	+9.1	+1.7
Pennsylvania bituminous	194,981	153,699	133,414	131,774	−32.4	−14.3	−1.2
Tennessee	11,244	7,691	7,849	7,619	−32.2	−.9	−2.9
Texas	2,452	1,674	1,462	1,313	−46.5	−21.6	−10.2
Utah	4,381	3,339	3,352	3,458	−21.1	+3.6	+3.2
Virginia	14,120	13,211	12,312	12,053	−14.6	−8.8	−2.1
Washington	4,306	3,407	3,099	2,946	−31.6	−13.5	−4.9
West Virginia	117,300	119,799	111,733	104,942	−10.5	−12.4	−6.1
Wyoming	7,529	5,791	4,843	4,839	−35.7	−16.4	−.1
Other States [1]	643	553	634	527	−18.0	−4.7	−16.9
Total bituminous	704,793	593,918	522,150	502,993	−28.6	−15.3	−3.7
Pennsylvania anthracite	157,743	165.259	160,681	151,501	−4.0	−8.3	−5.7
Grand total	862,536	759,177	682,831	654,494	−24.1	−13.8	−4.1

[1] Includes Alaska, Arizona (1927, 1928, and 1929), California, Georgia, Idaho, Nebraska (1924), Nevada (1927 and 1929), North Carolina, Oregon, and South Dakota.

CLASSIFICATION OF MINE EMPLOYEES

The employees engaged in coal mining fall into two groups. One group includes those who are directly engaged in winning the coal and who are paid by the piece at so much a ton. They are known collectively as "tonnage men," or often as "contract men," because each pieceworker in a sense is a contractor, obligating himself to get out coal and maintain his working place at a fixed rate of compensation. The tonnage men work underground.

The men in the other group are known collectively as "daymen," or sometimes as "company men." They are paid by the day. Their duties are concerned with the maintenance of the mine, with construction and repair work, with the operation of haulage and ventilation systems and the pumps, hoists, and power house, and with the work at the tipple, where the coal is dumped from mine car to railroad car and often cleaned, picked, or sized. The daymen are classified as "inside" and "outside" men, according as they work underground or on the surface.

In the anthracite region the terms "company men" and "contract men" are commonly applied to the two groups, and in the bituminous fields, although usage varies widely, the terms "tonnage men" and "daymen" are perhaps most frequently used.

There are exceptions to the statement that the men engaged directly in winning the coal are pieceworkers and that all others are paid according to time, for piece rates are sometimes applied to other tasks, and again men may be placed on the day roll while engaged in mining a bit of difficult coal where their tonnage rate would not yield a living wage. Broadly, however, the distinction holds.

To get approximate figures of the number of tonnage men, the operators since 1920 have been asked to report the number of "miners, hand or machine, loaders, and shot firers." (See Table 36.) This grouping would include pick miners, loaders after machines, and operators of the cutting machines themselves, also the small group of shot firers who are commonly paid by the piece and who perform, in the districts where they are employed, a task that elsewhere is a part of the work of the miner himself. The classification "all other workers underground," in this table, including the haulage and track employees, is practically equivalent to the inside daymen. The outside men are, with rare exceptions, all time-workers, although some are paid by the month rather than the day.

TABLE 36.—*Men employed underground and on the surface in coal mines, 1920–1929*

[Corresponding data for the years 1911 to 1919 will be found in Coal in 1926, p. 476]

Year	Underground						Surface		Total number
	Miners, loaders, and shot firers		All others[1]		Total underground		Number	Per cent	
	Number	Per cent	Number	Per cent	Number	Per cent			
Anthracite:									
1920	63,339	43.6	37,684	26.1	101,023	69.7	44,051	30.3	145,074
1921	73,977	46.4	42,840	26.8	116,817	73.2	42,682	26.8	159,499
1922	72,527	46.2	41,752	26.6	114,279	72.8	42,570	27.2	156,849
1923	72,362	45.9	42,359	26.8	114,721	72.7	43,022	27.3	157,743
1924	76,035	47.5	43,328	27.1	119,363	74.6	40,646	25.4	160,009
1925	78,773	49.1	41,795	26.1	120,568	75.2	39,744	24.8	160,312
1926	81,963	49.5	44,268	26.8	126,231	76.3	39,155	23.7	165,386
1927	82,583	50.0	44,614	27.0	127,197	77.0	38,062	23.0	165,259
1928	81,627	50.8	42,269	26.3	123,896	77.1	36,785	22.9	160,681
1929	77,395	51.1	40,461	26.7	117,856	77.8	33,645	22.2	151,501
Bituminous:									
1920	355,660	55.5	174,152	27.3	529,812	82.8	109,735	17.2	639,547
1921	399,270	60.1	168,019	25.4	567,289	85.5	96,465	14.5	663,754
1922	407,772	59.3	174,637	25.3	582,409	84.6	105,549	15.4	687,958
1923	422,040	59.9	178,265	25.3	600,305	85.2	104,488	14.8	704,793
1924	380,324	61.4	151,580	24.4	531,904	85.8	87,700	14.2	619,604
1925	367,456	62.5	139,085	23.6	506,541	86.1	81,952	13.9	588,493
1926	370,292	62.3	140,532	23.7	510,824	86.0	82,823	14.0	593,647
1927	372,565	62.7	139,541	23.5	512,106	86.2	81,812	13.8	593,918
1928	329,364	63.1	121,596	23.3	450,960	86.4	71,190	13.6	522,150
1929	315,678	62.8	118,321	23.5	433,999	86.3	68,994	13.7	502,993

[1] Includes haulage and track.

TABLE 37.—*Men employed in coal mines, by States, in 1929*

State	Underground						Surface		Total number
	Miners, loaders, and shot firers		Haulage and track		All others		Number	Per cent	
	Number	Per cent	Number	Per cent	Number	Per cent			
Alabama	15,287	60.6	2,961	11.8	3,244	12.9	3,716	14.7	25,208
Alaska	50	32.9	10	6.6	24	15.8	68	44.7	152
Arizona	33	84.7	2	5.1	2	5.1	2	5.1	39
Arkansas	2,906	67.6	412	9.6	316	7.3	665	15.5	4,299
California, Idaho, Nevada, and Oregon	23	54.8	3	7.1	6	14.3	10	23.8	42
Colorado	7,981	66.2	1,227	10.2	1,226	10.2	1,623	13.4	12,057
Georgia	-----	-----	-----	-----	-----	-----	102	100.0	102
Illinois	36,781	64.8	6,336	11.2	6,764	11.9	6,844	12.1	56,725
Indiana	8,852	58.1	1,615	10.6	1,561	10.2	3,222	21.1	15,250
Iowa	5,408	74.1	655	9.0	693	9.5	539	7.4	7,295
Kansas	3,638	70.8	333	6.5	218	4.2	950	18.5	5,139
Kentucky	36,090	61.5	7,586	12.9	7,203	12.3	7,770	13.3	58,649
Maryland	2,170	66.0	395	12.0	362	11.0	362	11.0	3,289
Michigan	899	67.3	164	12.3	154	11.5	119	8.9	1,336
Missouri	3,433	61.1	402	7.1	447	8.0	1,336	23.8	5,618
Montana	1,326	58.1	303	13.3	202	8.8	452	19.8	2,283
New Mexico	2,107	65.2	350	10.8	294	9.1	482	14.9	3,233
North Carolina	120	75.0	10	6.3	10	6.2	20	12.5	160
North Dakota	772	54.3	92	6.5	74	5.2	483	34.0	1,421
Ohio	17,689	69.6	2,452	9.7	2,093	8.2	3,165	12.5	25,399
Oklahoma	3,944	62.4	703	11.1	616	9.8	1,058	16.7	6,321
Pennsylvania bituminous	87,705	66.6	13,777	10.5	14,563	11.0	15,729	11.9	131,774
South Dakota	32	100.0	-----	-----	-----	-----	-----	-----	32
Tennessee	4,880	64.1	909	11.9	755	9.9	1,075	14.1	7,619
Texas	885	67.4	128	9.7	105	8.0	195	14.9	1,313
Utah	2,076	60.0	467	13.5	323	9.4	592	17.1	3,458
Virginia	6,509	54.0	1,714	14.2	1,982	16.5	1,848	15.3	12,053
Washington	1,810	61.4	333	11.3	346	11.8	457	15.5	2,946
West Virginia	59,324	56.5	15,984	15.2	14,278	13.6	15,356	14.7	104,942
Wyoming	2,948	60.9	629	13.0	508	10.5	754	15.6	4,839
Total bituminous	315,678	62.8	59,952	11.9	58,369	11.6	68,994	13.7	502,993
Pennsylvania anthracite	77,395	51.1	14,923	9.8	25,538	16.9	33,645	22.2	151,501
Grand total	393,073	60.1	74,875	11.4	83,907	12.8	102,639	15.7	654,494

DAYS WORKED BY MINES

TABLE 38.—*Average number of days worked by coal mines, by States, 1920–1929*

State	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Alabama	247	166	215	232	220	246	266	231	222	231
Alaska	240	244	147	220	287	243	221	229	224	174
Arizona	-----	-----	-----	-----	-----	-----	90	156	208	137
Arkansas	176	112	81	97	134	112	135	137	146	146
California [1]	181	149	250	206	156	174	103	208	177	113
Colorado	255	164	191	174	178	192	202	196	193	187
Georgia	294	183	242	231	248	220	253	250	280	260
Illinois	213	152	120	158	148	161	172	114	156	177
Indiana	192	128	110	136	136	159	173	120	150	172
Iowa	250	148	131	181	161	153	183	114	175	195
Kansas	204	137	125	139	151	169	158	138	128	160
Kentucky	182	152	140	152	174	206	230	237	212	222
Maryland	207	120	101	178	173	209	235	220	233	246
Michigan	261	196	162	222	178	186	171	188	187	217
Missouri	233	166	113	155	135	166	174	151	180	185
Montana	250	143	140	179	173	171	162	197	191	189
New Mexico	302	150	216	216	204	202	251	251	213	214
North Carolina	288	300	167	275	287	272	292	284	180	260
North Dakota	218	194	175	182	165	153	162	168	177	192
Ohio	188	134	100	150	143	151	159	98	171	201
Oklahoma	217	141	114	133	124	153	183	197	169	178
Oregon	307	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Pennsylvania bituminous	244	151	154	213	180	200	224	203	218	230
South Dakota	133	129	138	122	138	143	127	125	128	127

[1] California includes Idaho, 1920–1929; Oregon, 1921–1929; Nebraska in 1924; and Nevada in 1927 and 1929

TABLE 38.—*Average number of days worked by coal mines, by States, 1920–1929*—Continued

State	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Tennessee	234	154	163	183	159	211	234	235	226	228
Texas	242	139	185	178	166	150	195	202	203	212
Utah	252	151	204	160	182	179	186	209	191	211
Virginia	262	166	198	212	226	254	263	238	226	249
Washington	260	159	194	213	202	193	198	210	220	227
West Virginia	198	149	143	169	182	225	247	235	223	247
Wyoming	264	167	128	192	176	178	181	189	214	230
Total bituminous	220	149	142	179	171	195	215	191	203	219
Pennsylvania anthracite	271	271	151	268	274	182	244	225	217	225
Grand total	230	173	144	195	192	192	221	199	206	221

LENGTH OF WORKING DAY

ESTABLISHED WORKING DAY

The established working day in the coal mines of the United States is now generally eight hours. When market and other conditions permit the mines work six days a week, and the established working week is 48 hours. Since 1918 more than 90 per cent of the men have been employed in mines with an 8-hour working day. In 1920 the percentage in 8-hour mines reached 97.1; since then it has declined to 92.5 per cent in 1929. (See Table 40.) As indicated in Table 39, the proportion of 9 and 10 hour mines in 1929 was greater in the fields east of the Mississippi and south of the Ohio and Potomac Rivers.

TABLE 39.—*Number of bituminous-coal mines in the United States having established working day of certain length and number of men employed in 1929*

State	8 hours [1]		9 hours		10 hours		All others [2]		Total	
	Mines	Men	Mines	Men	Mines	Men	Mines	Men	Mines	Men
Alabama	69	5, 391	85	16, 971	14	1, 472	34	1, 374	202	25, 208
Alaska							7	152	7	152
Arkansas	72	4, 154			2	130	4	15	78	4, 299
Arizona, California, Idaho, Nevada, and Oregon	6	67					3	14	9	81
Colorado	141	11, 536			2	301	71	220	214	12, 057
Georgia	1	102							1	102
Illinois	329	54, 455	2	16			197	2, 254	528	56, 725
Indiana	143	15, 143					23	107	166	15, 250
Iowa	118	6, 946					83	349	201	7, 295
Kansas	108	4, 195	5	64	1	8	84	872	198	5, 139
Kentucky	444	52, 274	32	5, 585	8	363	17	427	501	58, 649
Maryland	60	3, 202	1	35			17	52	78	3, 289
Michigan	7	1, 336							7	1, 336
Missouri	136	5, 186	5	132	1	16	57	284	199	5, 618
Montana	26	1, 972	1	8	2	143	47	160	76	2, 283
New Mexico	35	3, 202					7	31	42	3, 233
North Carolina					1	160			1	160
North Dakota	33	865	2	63	4	177	104	316	143	1, 421
Ohio	349	23, 999	9	155	7	165	257	080	622	25, 399
Oklahoma	117	5, 934	7	351			9	36	133	6, 321
Pennsylvania	1, 255	126, 752	45	2, 889	1	29	144	2, 104	1, 445	131, 774
South Dakota							14	32	14	32
Tennessee	76	6, 473	3	470	3	671	1	5	83	7, 619
Texas	16	762	6	331	1	215	1	5	24	1, 313
Utah	38	3, 446					4	12	42	3, 458
Virginia	86	11, 699	3	210			2	144	91	12, 053
Washington	40	2, 912					8	34	48	2, 946
West Virginia	766	98, 530	39	5, 713	4	118	41	581	850	104, 942
Wyoming	48	4, 817	1	10			5	12	54	4, 839
	4, 519	455, 350	246	33, 003	51	3, 968	1, 241	10, 672	6, 057	502, 993

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[1] Includes outside employees working 9 or 10 hours a day at many mines where the established time for underground workers is 8 hours.

[2] Includes employees in mines where the established working day was changed during year, where the working day was irregular, or which failed to answer the inquiry.

TABLE 40.—*Per cent of men employed in bituminous-coal mines that had established working days of 8, 9, and 10 hours, 1905–1929* [1]

Year	Per cent of total employees in—			Weighted average working day (hours)	Year	Per cent of total employees in—			Weighted average working day (hours)
	8-hour mines	9-hour mines	10-hour mines			8-hour mines	9-hour mines	10-hour mines	
1905	61.1	13.6	25.3	8.6	1918	90.6	6.7	2.7	8.12
1906	63.0	13.5	23.5	8.6	1919	95.5	3.5	1.0	8.06
1907	64.0	11.6	24.4	8.6	1920	97.1	2.0	.9	8.04
1908	63.5	11.1	25.4	8.6	1921	96.6	2.9	.5	8.04
1910	62.1	11.3	26.6	8.6	1922	95.1	4.0	.9	8.06
1911	62.9	10.9	26.2	8.6	1923	94.7	4.2	1.1	8.06
1912	61.6	11.5	26.9	8.6	1924	93.7	5.1	1.2	8.08
1913	61.9	15.2	22.9	8.6	1925	93.5	5.4	1.1	8.08
1914	60.7	15.4	23.9	8.6	1926	93.7	5.5	.8	8.07
1915	59.6	17.0	23.4	8.6	1927	93.4	5.6	1.0	8.08
1916	58.6	17.4	24.0	8.6	1928	93.1	6.1	.8	8.08
1917	79.0	12.6	8.4	8.3	1929	92.5	6.7	.8	8.08

[1] Calculated on basis of total number of men in mines definitely reported as having 8, 9, or 10 hour day. A small number of mines that work more than 10 hours or less than 8 hours have been excluded, as have also all mines for which the reports were defective or which changed their working day during the year.

AVERAGE TIME SPENT UNDERGROUND

In discussing the length of the working day in the coal mines it is necessary to distinguish between the established working day and the time actually spent at work. The established working day does not of itself measure the length of time the men actually work, because the mine may shut down before the full day is out, because the miner may go home before the mine stops, and because he spends a certain amount of time going to and from his place of work underground. Allowing for these other factors, how much time does the man actually spend at work and how long is he underground?

As interpreted in the union wage agreements, the 8-hour day means eight hours of labor at the usual working place, exclusive of time for lunch and exclusive of time spent in going from the entrance of the mine to the working place and back again. In general, this provision applies both to pieceworkers and day-wage workers underground, although certain classes of daymen have duties to be performed outside the eight hours. Motormen and drivers are ordinarily required to take motors and mules on their own time to and from the stables and the parting or station where they begin hauling, and this time is not counted as part of the day's labor.

Although the wage agreements specify eight hours of labor, it does not follow that men are always at work eight hours in the day. Shortage of railroad cars at the tipple, lack of orders, a petty strike, or a breakdown within the mine may cause it to stop work before the eight hours are over. Time workers may lose fractional days through sickness or accident. In particular, the tonnage men, who constitute 40 to 70 per cent of the working force, may leave early before the mine as a whole stops work, because the custom of the industry allows them that freedom. Only in the rarest instances is a record kept of the time these men are in the mine. Sometimes they leave because they have finished their allotted work for the day, sometimes because they feel sick or have other interests to attend to, or sometimes simply because they have earned enough for one day. The amount and the causes of this early quitting have been a subject of discussion and even of controversy between operators and employees.

The nominal working day, therefore, measures neither the length of time spent by the men at work nor the length of time they are underground, and it was not until recently that any figures on these points were available. In connection with its periodic surveys of miners' earnings, the Bureau of Labor Statistics arranged to have a special record kept of the time actually spent in the mine by many thousands of tonnage men during typical biweekly pay periods. The results, which show the time spent at the working place and also the total time in the mine, will be found in publications of the Bureau of Labor Statistics, United States Department of Labor, as follows: Monthly Labor Review for July, 1925, pages 68 to 87, and for February, 1926, pages 77 to 87, and Bulletins 316, 416, and 454.

OUTPUT PER MAN

TABLE 41.—*Coal produced per man per day and per year, by States, 1920–1929, in net tons*

[Calculated from the total production, including strip-mined coal, and the total number of men employed above and below ground, excluding coke workers and office force]

State	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Per man per day:										
Alabama	2.56	2.93	3.01	2.93	3.11	3.00	2.89	3.10	3.09	3.08
Arkansas	2.94	3.03	3.32	3.39	3.24	2.99	3.00	3.05	2.79	2.70
Colorado	3.51	3.83	3.87	[1] 4.45	[1] 4.52	[1] 4.07	[1] 4.11	[1] 4.13	[1] 4.13	[1] 4.40
Illinois	4.78	4.80	5.05	5.02	5.16	5.33	5.31	5.36	5.57	6.06
Indiana	4.86	4.86	5.19	5.43	5.75	5.89	5.72	6.13	6.51	7.00
Iowa	2.61	2.69	2.55	2.75	2.80	3.02	2.85	2.96	3.02	2.98
Kansas	3.19	3.08	3.02	3.19	3.29	3.44	3.43	3.57	3.68	3.63
Kentucky	3.95	4.11	4.89	4.83	4.67	4.68	4.52	4.50	4.69	4.64
Maryland	3.50	3.27	3.15	3.42	3.27	3.61	3.56	3.70	3.50	3.28
Michigan	2.65	2.63	2.65	2.67	3.00	2.75	2.55	2.67	2.67	2.77
Missouri	2.56	2.50	2.88	3.07	3.08	3.18	3.27	3.26	3.47	3.87
Montana	4.19	4.57	5.03	5.00	5.26	6.64	7.14	6.99	7.93	7.90
New Mexico	3.26	3.58	3.61	3.28	3.25	3.68	3.54	3.38	3.70	3.79
North Dakota	3.75	4.19	4.39	4.60	5.62	6.61	6.56	6.78	7.00	6.84
Ohio	4.73	4.60	4.92	4.95	4.82	4.67	4.56	4.52	4.28	4.64
Oklahoma	2.70	2.70	3.12	2.99	3.05	2.70	2.88	3.35	3.34	3.36
Pennsylvania bituminous	3.96	4.03	3.84	4.15	4.27	4.36	4.37	4.26	4.52	4.73
Tennessee	2.48	2.80	2.59	2.93	3.05	3.11	3.11	3.20	3.16	3.11
Texas	2.26	2.42	2.10	2.72	3.16	3.19	3.39	3.92	3.99	3.95
Utah [1]	5.29	6.10	5.18	6.73	5.70	5.90	6.65	6.84	7.57	7.07
Virginia	3.06	3.78	3.93	3.92	3.73	3.69	3.91	4.11	4.28	4.24
Washington	2.89	3.52	2.96	3.19	3.41	3.52	3.62	3.68	3.70	3.77
West Virginia	4.39	4.79	5.10	5.44	5.48	4.94	4.90	5.15	5.35	5.34
Wyoming	4.69	5.08	5.15	5.23	5.41	5.90	6.15	6.18	6.34	6.02
Total bituminous	4.00	4.20	4.28	4.47	4.56	4.52	4.50	4.55	4.73	4.85
Pennsylvania anthracite	[2] 2.28	2.09	[2] 2.31	2.21	2.00	2.12	2.09	2.15	2.17	2.17
Grand total	3.65	3.55	3.89	3.91	3.81	4.04	3.92	3.96	4.10	4.21
man per year:										
Alabama	632	487	647	680	684	738	768	716	685	712
Arkansas	517	340	269	329	433	335	407	418	406	394
Colorado	895	628	740	774	806	781	830	810	796	823
Illinois	1,018	729	606	795	765	860	914	609	871	1,069
Indiana	934	622	571	738	779	934	991	737	975	1,203
Iowa	653	398	334	498	452	464	522	337	529	581
Kansas	650	422	377	443	496	580	540	492	469	579
Kentucky	718	625	684	735	810	966	1,039	1,068	995	1,031
Maryland	726	392	318	608	565	753	836	814	813	805
Michigan	691	516	429	593	536	512	437	501	498	602
Missouri	596	415	326	477	415	527	571	492	626	717
Montana	1,048	654	704	896	909	1,136	1,157	1,378	1,517	1,493
New Mexico	985	536	779	708	662	742	890	849	788	811
North Dakota	818	813	769	837	925	1,013	1,064	1,139	1,236	1,310
Ohio	890	617	492	742	689	707	723	445	732	933
Oklahoma	586	380	356	398	379	413	526	659	563	597
Pennsylvania bituminous	966	609	592	882	772	873	981	865	983	1,089
Tennessee	580	431	422	536	487	656	728	752	715	709
Texas	547	336	389	484	523	478	661	793	809	838
Utah	1,333	922	1,057	1,077	1,037	1,056	1,234	1,432	1,445	1,492
Virginia	803	628	779	832	843	936	1,027	978	967	1,058
Washington	752	560	575	680	688	681	717	773	813	856
West Virginia	869	715	729	919	995	1,111	1,209	1,211	1,190	1,320
Wyoming	1,237	849	659	1,004	950	1,051	1,111	1,166	1,357	1,386
Total bituminous	881	627	609	801	781	884	966	872	959	1,064
Pennsylvania anthracite	[2] 618	567	[2] 349	592	550	386	511	485	469	487
Grand total	839	615	565	763	733	777	867	788	844	930

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[1] Probably too high because of practice common in some districts of men going into mine to shoot coal and load mine cars on days when tipples or mines, as a whole, are not in operation.

[2] Heavy washery output.

TABLE 42.—*Bituminous coal produced underground per man employed underground, by States, in 1929*

State	Total tons mined underground	Total number underground men	Average number days worked	Average tons per underground man	
				Per year	Per day
Alabama	17,625,695	21,492	231	820	3.55
Alaska	100,610	84	174	1,198	6.89
Arkansas	1,615,405	3,634	146	445	3.05
Colorado [1]	9,920,741	10,434	187	951	5.09
Illinois	55,282,828	49,881	177	1,108	6.26
Indiana	12,731,250	12,028	172	1,058	6.15
Iowa	4,241,069	6,756	195	628	3.22
Kansas	1,954,282	4,189	160	467	2.92
Kentucky	60,066,931	50,879	222	1,181	5.32
Maryland	2,649,114	2,927	246	905	3.68
Michigan	804,869	1,217	217	661	3.05
Missouri	2,044,014	4,282	185	477	2.58
Montana	2,188,699	1,831	189	1,195	6.32
New Mexico	2,622,769	2,751	214	953	4.45
North Carolina	52,180	140	260	373	1.43
North Dakota	1,000,991	938	192	1,067	5.56
Ohio	21,921,796	22,234	201	986	4.91
Oklahoma	3,281,431	5,263	178	623	3.50
Pennsylvania	142,866,356	116,045	230	1,231	5.35
South Dakota	12,854	32	127	402	3.17
Tennessee	5,357,420	6,544	228	819	3.59
Texas	790,748	1,118	212	707	3.33
Utah [1]	5,160,521	2,866	211	1,801	8.54
Virginia	12,748,306	10,205	249	1,249	5.02
Washington	2,521,327	2,489	227	1,013	4.46
West Virginia	138,505,793	89,586	247	1,546	6.26
Wyoming	6,632,041	4,085	230	1,624	7.06
Other States	20,454	69	146	296	2.03
	514,720,494	433,999	219	1,186	5.42

[1] See Table 41, footnote 1.

TABLE 43.—*Coal produced from deep mines per man employed underground per day worked, 1911–1929, in net tons* [1]

Year	Anthracite [2]	Bituminous	Year	Anthracite [2]	Bituminous
1911	2.75	4.01	1921	2.70	4.86
1912	2.69	4.24	1922	2.87	4.98
1913	2.67	4.16	1923	2.70	5.15
1914	2.67	4.28	1924	2.53	5.17
1915	2.78	4.49	1925	2.60	5.09
1916	2.74	4.57	1926	2.53	5.07
1917	2.89	4.51	1927	2.58	5.11
1918	2.94	4.62	1928	2.60	5.26
1919	2.81	4.64	1929	2.64	5.42
1920	2.93	4.80			

[1] In making this computation certain estimates had to be made of the division of workers above and below ground and of the production of strip pits in the years 1911 to 1913. The probable error introduced by these estimates is too small to impair the value of the averages.

[2] Beginning with 1923, a small tonnage of culm-bank coal handled through breakers and hitherto counted as fresh-mined coal has been excluded, and the figures are therefore not exactly comparable with earlier years. The difference, however, is small. (See pp. 841 and 842.)

STRIKES, SUSPENSIONS, AND LOCKOUTS

TABLE 44.—*Men idle in strikes, suspensions, and lockouts and time lost thereby in comparison with time lost for other causes, 1920–1929*

[Includes both anthracite and bituminous-coal mines]

Year	Number of men on strike	Average number of days lost		Man-days lost—		
		Per man striking	Per man employed	On account of strikes, suspensions, and lockouts	On account of no market, car shortage, and similar difficulties [1]	Total
1920	282, 419	21	8	5, 914, 473	55, 732, 698	61, 647, 171
1921	151, 263	21	4	3, 106, 103	108, 332, 246	111, 438, 349
1922	603, 031	122	87	73, 497, 043	65, 186, 691	138, 683, 734
1923	197, 214	20	4	3, 868, 543	93, 359, 474	97, 228, 017
1924	129, 452	41	7	5, 362, 748	84, 963, 306	90, 326, 054
1925	186, 369	88	22	16, 433, 036	69, 624, 737	86, 057, 773
1926	174, 724	38	9	6, 707, 778	58, 424, 553	65, 132, 331
1927	193, 322	138	35	26, 675, 109	55, 488, 392	82, 163, 501
1928	86, 870	53	7	4, 605, 086	[2] 64, 379, 657	[2] 68, 984, 743
1929	58, 052	8	1	468, 453	55, 970, 492	56, 438, 945

[1] Computed by the Bureau of Mines from the operators' reports of time worked, on the assumption that the potential working time was 308 days. For 1925 and 1926, however, the potential working time of the anthracite region has been assumed to be 304 days, and for 1927 and 1929, 303.5 days.

[2] Revised figures.

TABLE 45.—*Strikes, suspensions, and lockouts in coal mines, by States, in 1929*

State	Total number of men employed	Number of men on strike	Man-days idle on account of strike	Average number of days lost on account of strike	
				Per man employed	Per man on strike
Alabama	25, 208				
Arkansas	4, 299	95	2, 177	(1)	23
Colorado	12, 057				
Illinois	56, 725	10, 162	68, 155	1	7
Indiana	15, 250	3, 851	58, 553	4	15
Iowa	7, 295	810	2, 434	(1)	3
Kansas	5, 139	106	3, 341	1	32
Kentucky	58, 649	561	4, 286	(1)	8
Maryland	3. 289				
Michigan	1, 336	762	3, 894	3	5
Missouri	5, 618	211	633	(1)	3
Montana	2, 283				
New Mexico	3, 233				
North Dakota	1, 421				
Ohio	25, 399	943	46, 165	2	49
Oklahoma	6, 321				
Pennsylvania bituminous	131, 774	313	4, 073	(1)	13
Tennessee	7, 619	200	1, 200	(1)	6
Texas	1, 313				
Utah	3, 458				
Virginia	12, 053	110	880	(1)	8
Washington	2, 946				
West Virginia	104, 942				
Wyoming	4, 839	151	151	(1)	1
Other States	527				
Total bituminous	502, 993	18, 275	195, 942	(1)	11
Pennsylvania anthracite	151, 501	39, 777	272, 511	2	7
Grand total	654, 494	58, 052	468, 453	1	8

[1] One-half day or less.

EQUIPMENT AND METHODS OF MINING AND PREPARATION

The economic difficulties of the bituminous industry in recent years have diverted attention from the brilliant progress it has made in the field of engineering. To record the rapid changes going on in both mining and preparation practice, the following section is devoted to statistics of the mechanical equipment of the mines. Because of the many kinds of equipment used it is planned to select one or more features for special analysis each year. In this way special attention was given to underground haulage equipment in the 1925 report,[11] to mechanical loading in 1926,[12] to screening equipment in 1927,[13] and to a general review of engineering progress in 1928.[14] During 1929 the subjects selected for special analysis were coal stripping, loading machinery, and mechanical cleaning.

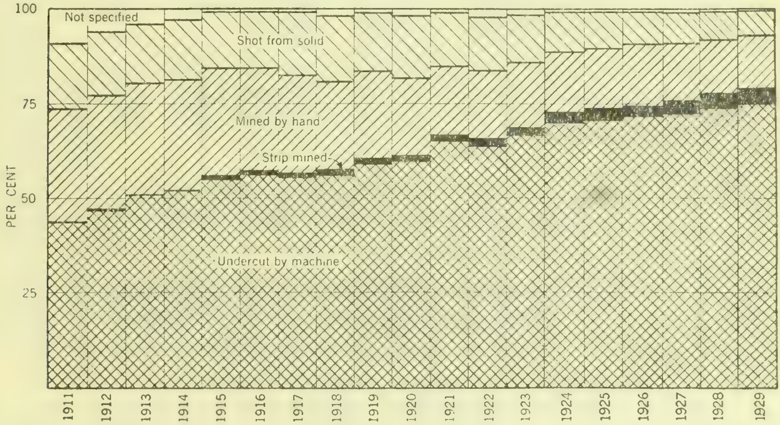

FIGURE 48.—Per cent of total output of bituminous coal mined by different methods, 1911–1929

In compiling such data no publicity is given to individual makes of equipment, but it is often possible to classify equipment by types and to show the relative growth and distribution of each type. Such information is useful to operators in selecting equipment and to manufacturers in establishing sales quotas and in gaging the future market.

Figure 48 records some of the outstanding changes in mining methods in recent years.

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[11] Coal in 1925, pp. 440–448. See also Rogers, H. O., Exit the Mule: Coal Age, August, 1927, vol. 32, pp. 84–88.

[12] Coal in 1926, p. 490. See also Tryon, F. G., Figures on Mechanical Production in Coal Fields of the United States: Min. Cong. Jour., June, 1928, pp. 413–416.

[13] Coal in 1927, pp. 384–394.

[14] Coal in 1928, pp. 481–490. See also Smith, George Otis, and Tryon, F. G., Development of the American Coal Industry, 1913–1928: World Eng. Cong., Tokyo, October, 1929.

METHODS OF CUTTING AND SHOOTING

TABLE 46.—*Bituminous coal mined by different methods, by States, in 1929*

State	Mined by hand		Shot off the solid		Cut by machines		From strip pits		Not specified		Total production, net tons
	Net tons	Per cent	Net tons	Per cent	Net tons	Per cent	Net tons	Per cent	Net tons	Per cent	
Alabama	1,875,724	10.4	3,832,947	21.4	11,901,694	66.3	318,228	1.8	15,330	0.1	17,943,923
Alaska	10,060	10.0	90,550	90.0							100,610
Arizona	1,956	19.3	8,176	80.7							10,132
Arkansas	4,046	.2	783,182	46.2	827,177	48.8	79,703	4.7	1,000	.1	1,695,108
Colorado	3,654,150	36.8	675,100	6.8	5,575,815	56.2			15,676	.2	9,920,741
Georgia							44,636	100.0			44,636
Illinois	1,422,994	2.3	7,604,805	12.5	46,147,855	76.1	5,374,813	8.9	107,174	.2	60,657,641
Indiana	902,960	4.9	1,786,204	9.7	10,032,052	54.7	5,613,108	30.6	10,034	.1	18,341,358
Iowa	489,369	11.5	2,416,232	57.0	1,282,612	30.2			52,856	1.3	4,241,069
Kansas	143,608	4.8	1,505,896	50.6	262,247	8.8	1,021,689	34.4	42,531	1.4	2,975,971
Kentucky:											
Eastern	2,397,521	5.2	941,062	2.1	42,676,103	92.7			10,766		46,025,452
Western	3,577		1,029,614	7.1	13,002,790	90.1	395,669	2.8	5,498		14,437,148
Maryland	1,964,173	74.1	30,846	1.2	647,096	24.4			6,999	.3	2,649,114
Michigan			16,539	2.1	788,330	97.9					804,869
Missouri	355,377	8.8	526,857	13.1	1,118,870	27.7	1,986,297	49.3	42,910	1.1	4,030,311
Montana	10,924	.3	444,309	13.0	1,699,421	49.9	1,218,827	35.8	34,045	1.0	3,407,526
New Mexico	1,278,132	48.7	770,235	29.4	573,233	21.9			1,169		2,622,769
North Carolina	20,350	39.0	31,830	61.0							52,180
North Dakota	21,529	1.2	182,661	9.8	714,074	38.3	861,139	46.3	82,727	4.4	1,862,130
Ohio	506,946	2.1	269,316	1.1	20,985,481	88.6	1,767,681	7.5	160,053	.7	23,689,477
Oklahoma			729,792	19.3	2,547,940	67.5	492,649	13.1	3,699	.1	3,774,080
Pennsylvania	38,612,464	26.9	3,828,436	2.7	100,368,094	69.9	649,885	.5	57,362		143,516,241
South Dakota									12,854	100.0	12,854
Tennessee	655,406	12.1	1,442,937	26.7	3,257,146	60.3	48,044	.9	1,931		5,405,464
Texas	248,162	22.5	519,124	47.2	23,462	2.1	309,920	28.2			1,100,668
Utah	86,568	1.7	[1] 1,014,326	19.6	4,059,627	78.7					5,160,521
Virginia	175,135	1.4	1,651,732	12.9	10,921,439	85.7					12,748,306
Washington	1,077,151	42.7	743,901	29.5	699,099	27.7			1,176	.1	2,521,327
West Virginia	17,777,767	12.8	1,910,231	1.3	118,802,772	85.7	13,062	.1	15,023	.1	138,518,855
Wyoming	649,983	9.7	1,289,770	19.2	4,692,288	70.0	72,749	1.1			6,704,790
Other States			10,322	100.0							10,322
	74,346,032	13.9	36,086,932	6.8	403,606,717	75.4	20,268,099	3.8	680,813	0.1	534,988,593

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[1] Includes 501,459 tons reported by the companies as "pillar coal," the method of mining which of course differs materially from solid shooting in rooms or entries. Indeed most of the coal reported as shot off the solid in Utah is probably "pillar coal."

UNDERCUTTING MACHINES

TABLE 47.—*Number of coal-cutting machines in bituminous-coal mines, average output per machine, and per cent of total product cut by machines, by States, 1913, 1923, 1928, and 1929*

State	Number of coal-cutting machines in use				Average output per machine (net tons)				Per cent of total product cut by machines[1]			
	1913	1923	1928	1929	1913	1923	1928	1929	1913	1923	1928	1929
Alabama	377	395	445	407	10, 940	22, 067	25, 262	29, 242	23. 3	42. 6	63. 8	66. 3
Arkansas	27	40	94	96	9, 300	4, 769	6, 870	8, 616	11. 2	14. 6	38. 9	48. 8
Colorado	300	440	404	388	7, 705	11, 129	13, 609	14, 371	25. 0	47. 3	55. 8	56. 2
Illinois	1, 845	3, 151	2, 186	2, 107	17, 686	17, 191	19, 325	21, 902	53. 0	68. 3	75. 5	76. 1
Indiana	732	852	512	417	13, 302	16, 107	16, 588	24, 058	56. 7	54. 3	51. 9	54. 7
Iowa	28	81	84	96	4, 311	14, 584	14, 280	13, 361	1. 6	20. 7	32. 6	30. 2
Kansas	9	22	44	43	2, 458	4, 452	5, 665	6, 099	. 3	2. 2	8. 9	8. 8
Kentucky	1, 263	1, 928	1, 969	1, 876	11, 365	19, 559	28, 890	29, 680	73. 2	84. 2	91. 9	92. 1
Maryland	13	47	44	41	6, 384	12, 398	14, 486	15, 783	1. 7	25. 5	23. 7	24. 4
Michigan	130	80	59	61	6, 636	13, 579	10, 303	12, 923	70. 0	92. 7	98. 5	97. 9
Missouri	104	135	101	99	8, 307	7, 450	10, 628	11, 302	20. 0	29. 6	28. 8	27. 7
Montana	97	95	80	85	11, 099	15, 746	20, 616	19, 993	33. 2	47. 5	49. 6	49. 9
New Mexico	44	107	74	85	11, 297	7, 960	9, 798	6, 744	13. 4	29. 2	26. 7	21. 9
North Carolina	-------	1	-------	-------	-------	5, 000	-------	-------	-------	13. 9	-------	-------
North Dakota	13	25	24	26	17, 094	17, 040	26, 525	27, 464	44. 9	30. 8	38. 6	38. 3
Ohio	1, 681	2, 351	906	1, 019	19, 418	15, 260	13, 436	20, 594	90. 2	88. 5	77. 8	88. 6
Oklahoma	103	183	166	183	6, 511	8, 943	13, 390	13, 923	16. 1	56. 7	63. 4	67. 5
Pennsylvania	6, 301	6, 481	4, 293	4, 147	14, 678	17, 020	20, 720	24, 203	53. 2	64. 1	67. 8	69. 9
Tennessee	252	171	146	137	7, 312	11, 692	22, 607	23, 775	26. 7	33. 1	58. 8	60. 3
Texas	24	5	2	2	4, 204	8, 904	9, 871	11, 731	4. 2	3. 8	1. 7	2. 1
Utah	50	192	160	145	12, 510	16, 778	23, 027	27, 997	19. 2	68. 3	76. 1	78. 7
Virginia	187	277	267	261	22, 497	31, 210	38, 246	41, 845	47. 6	73. 5	85. 8	85. 7
Washington	63	26	20	64	4, 453	9, 726	13, 759	10, 923	7. 2	8. 6	10. 9	27. 7
West Virginia	2, 539	3, 936	2, 989	2, 718	15, 500	21, 592	37, 706	43, 710	55. 3	78. 7	84. 8	85. 7
Wyoming	195	208	192	228	15, 645	18, 237	22, 716	20, 580	41. 3	50. 1	66. 4	70. 0
Other States	2	-------	-------	-------	600	-------	-------	-------	4. 8	-------	-------	-------
	16, 379	21, 229	15, 261	14, 731	14, 801	17, 779	24, 224	27, 398	50. 7	66. 9	73. 8	75. 4

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[1] Calculated from the total production, including that of strip mines. Were stripping excluded, the percentage cut by machine would appear much larger in several States.

TABLE 48.—*Coal mined by undercutting machines, 1920–1929*

Year	Anthracite				Bituminous coal			
	Machines in use	Quantity mined by undercutting machines (net tons)		Per cent of total fresh-mined product cut by machines	Machines in use	Quantity mined by undercutting machines (net tons)		Per cent of total product cut by machines
		Total	Average per machine			Total	Average per machine	
1920	139	938, 073	6, 749	1. 1	19, 103	339, 813, 476	17, 788	59. 8
1921	114	979, 145	8, 589	1. 1	19, 618	272, 702, 389	13, 901	65. 6
1922	82	502, 793	6, 132	1. 0	20, 436	267, 032, 931	13, 067	63. 2
1923	162	1, 208, 542	7, 460	1. 4	21, 229	377, 435, 543	17, 779	66. 9
1924	212	1, 423, 884	6, 716	1. 7	18, 660	336, 271, 335	18, 021	69. 5
1925	159	941, 189	5, 919	1. 6	17, 551	366, 725, 758	20, 895	70. 6
1926	90	931, 650	10, 352	1. 2	17, 466	410, 912, 680	23, 526	71. 7
1927	138	1, 171, 888	8, 492	1. 5	17, 388	374, 040, 637	21, 511	72. 2
1928	193	1, 289, 809	6, 683	1. 8	15, 261	369, 687, 007	24, 224	73. 8
1929	137	1, 159, 910	8, 466	1. 6	14, 731	403, 606, 717	27, 398	75. 4

STRIPPING OPERATIONS

TOTAL STRIPPED BY ALL METHODS

Because of the sharp differences between open-pit and underground mining, it is desirable for many purposes to separate the two in the statistical record. This is not feasible in the primary tables of this report showing production by counties (p.753), because in many cases there is only one strip pit in a county and separation would disclose the business of individual companies. In Table 49, however, the reports of stripping operations in the bituminous fields are tabulated separately in as great geographic detail as possible. Corresponding figures for Pennsylvania anthracite are given in Table 26A, page 857.

Coal is recovered by stripping at three types of operations: (1) Small pits, without power shovels, where the overburden is removed by horse-drawn scrapers, or even by hand, and the coal itself is loaded by hand; (2) power strip pits proper, where the overburden and usually the coal also are handled by steam or electric shovels; and (3) mines combining stripping and underground methods in the same operation. All three types are included in Table 49, and as the returns for the combination strip and underground operations do not permit separating men engaged in other work from those engaged in stripping, the figures of men employed represent all persons working about the property, including those underground.

TABLE 49.—*Stripping operations of all types in the bituminous-coal fields, by States and counties, in 1929*

[For mines that recover coal both by stripping and by underground operations the returns do not permit separating men engaged in stripping from those engaged in other work. For this reason the figures of men employed represent all persons working at these mines, including those underground. The total tons produced by both methods at these same mines are also shown. Small horse-stripping operations are included]

State and county	Number of strip pits	Number of shovels	Coal produced (net tons)		Total value at same mines	Average value per ton	Number of employees				Average number of days worked	Per cent of county or State total that was mined by stripping	Average tons per man per day
			Mined by stripping	Total at same mines			Underground		Surface	Total			
							Miners, loaders, and shot firers	All others [1]					
Alabama: Bibb, Blount, and Walker	[2] 11	18	318, 228	436, 748	$825, 000	$1. 89	143	42	331	516	177	[3] 4. 9	4. 78
Georgia: Walker	1	3	44, 636	44, 636	136, 000	3. 05	----	----	102	102	260	100. 0	1. 68
Illinois:													
Edgar, Fulton, Henry, Jackson, La Salle, Livingston, Peoria, St. Clair, Saline, Vermilion, and Will	17	52	3, 336, 247	3, 348, 247	5, 088, 000	1. 52	40	5	1, 026	1, 071	172	20. 6	18. 22
Perry	4	19	1, 657, 130	1, 657, 130	2, 815, 000	1. 70	----	----	507	507	164	56. 4	19. 88
Williamson	3	4	381, 436	381, 436	535, 000	1. 40	----	----	121	121	147	7. 3	21. 45
State total	[2] 24	75	5, 374, 813	5, 386, 813	8, 438, 000	1. 57	40	5	1, 654	1, 699	168	8. 9	18. 91
Indiana:													
Clay	3	10	618, 914	618, 914	916, 000	1. 48	----	----	249	249	233	57. 7	10. 67
Greene	6	11	705, 241	706, 941	1, 052, 000	1. 49	3	----	260	263	150	48. 7	17. 93
Owen, Sullivan, Vermillion, Vigo, and Warrick	10	32	1, 969, 463	1, 969, 463	2, 926, 000	1. 49	----	----	736	736	181	15. 2	14. 75
Pike	5	20	2, 319, 490	2, 319, 490	3, 067, 000	1. 32	----	----	699	699	209	93. 4	15. 84
State total	24	73	5, 613, 108	5, 614, 808	7, 961, 000	1. 42	3	----	1, 944	1, 947	194	30. 6	14. 88
Kansas:													
Bourbon	4	3	27, 240	27, 240	69, 000	2. 53	----	----	48	48	249	94. 0	2. 28
Cherokee	11	11	307, 140	307, 140	556, 000	1. 81	----	----	166	166	126	58. 7	14. 68
Crawford	17	18	687, 309	687, 309	1, 411, 000	2. 05	----	----	411	411	134	30. 3	12. 51
State total	[2] 32	32	1, 021, 689	1, 021, 689	2, 036, 000	1. 99	----	----	625	625	140	34. 4	11. 64
Kentucky: Hopkins and Muhlenberg	8	22	395, 669	395, 669	429, 000	1. 08	----	----	377	377	73	[3] 4. 3	14. 41
Missouri:													
Barton	16	29	1, 434, 202	1, 434, 202	3, 018, 000	2. 10	----	----	585	585	157	88. 4	15. 64
Bates	5	7	195, 780	195, 780	393, 000	2. 01	----	----	158	158	152	72. 5	8. 15
Callaway and Jasper	2	3	12, 874	12, 874	42, 000	3. 26	----	----	26	26	226	31. 9	2. 19

[1] Includes haulage and track men.

[2] Includes some pits in which the stripping is done by horse or hand methods.

[3] Per cent of county totals, not State.

TABLE 49.—*Stripping operations of all types in the bituminous-coal fields, by States and counties, in 1929*—Continued

State and county	Number of strip pits	Number of shovels	Coal produced (net tons)		Total value at same mines	Average value per ton	Number of employees				Average number of days worked	Per cent of county or State total that was mined by stripping	Average tons per man per day
							Underground						
			Mined by stripping	Total at same mines			Miners, loaders, and shot firers	All others	Surface	Total			
Missouri—Continued.													
Henry	3	6	258, 169	258, 169	$493, 000	$1. 91			104	104	203	92. 2	12. 23
Vernon	3	3	85, 272	85, 272	192, 000	2. 25			91	91	121	91. 9	7. 73
State total	29	48	1, 986, 297	1, 986, 297	4, 138, 000	2. 08			964	964	159	49. 3	12. 92
Montana: Rosebud	1	8	1, 218, 827	1, 218, 827	1, 828, 000	1. 50			136	136	347	[3] 99. 9	25. 86
North Dakota:													
Bowman, Burke, Mercer, Morton, and Ward	7	14	770, 579	770, 579	1, 240 000	1. 61			204	204	200	63. 0	18. 91
Hettinger	4	1	9, 617	9, 617	15, 000	1. 56			13	13	225	41. 2	3. 29
McLean	3	3	77, 634	77, 634	155, 000	2. 00			84	84	142	74. 1	6. 49
Oliver	3		3, 309	3, 309	5. 000	1. 51			6	6	202	100. 0	2. 73
State total	[2] 17	18	861, 139	861, 139	1, 415, 000	1. 64			307	307	185	46. 3	15. 15
Ohio:													
Harrison	9	29	1, 235, 919	1, 235, 919	1, 368, 000	1. 11			559	559	162	44. 5	13. 66
Jefferson	5	12	413, 603	459, 717	653, 000	1. 42			229	229	175	11. 4	11. 48
Perry and Stark	4	10	102, 010	102, 010	138, 000	1. 35			75	75	134	11. 2	10. 18
Tuscarawas	4	3	16, 149	27, 651	59, 000	2. 13	7	2	8	17	271	1. 4	6. 01
State total	[2] 22	54	1, 767, 681	1, 825, 297	2, 218, 000	1. 22	7	2	871	880	165	7. 5	12. 58
Oklahoma: Haskell, Mayes, Muskogee, Rogers, Tulsa, and Wagoner	[2] 11	18	492, 649	507, 731	1, 233, 000	2. 43	29	2	447	478	164	13. 1	6. 46
Pennsylvania:													
Allegheny, Beaver, Clearfield, Clinton, Fayette, Jefferson, Somerset, and Westmoreland	9	15	413, 807	1, 086, 212	2, 212, 000	2. 04	154	168	321	643	250	. 5	6. 76
Washington	4	12	236, 078	429, 390	618, 000	1. 44	104	32	157	293	202	1. 2	7. 25
State total	13	27	649, 885	1, 515, 602	2, 830, 000	1. 87	258	200	478	936	235	. 5	6. 89
Other States [4]	7	15	523, 478	523, 478	591, 000	1. 13			269	269	163	[3] 6. 9	11. 94
Grand total	200	411	20, 268, 099	21, 338, 734	34, 078, 000	1. 60	480	251	8, 505	9, 236	178	3. 8	13. 01

[2] Includes some pits in which the stripping is done by horse or hand methods. [3] Per cent of county totals, not State. [4] Arkansas, Tennessee, Texas, West Virginia, and Wyoming.

The total quantity of soft coal recovered by stripping operations of all types in 1929 was 20,268,099 tons. Table 50, which gives corresponding figures back to the beginning of the statistical record, brings out the extremely rapid growth that has characterized this branch of mining in the bituminous fields. In 1914 the quantity obtained by stripping was 1,280,946 tons, and in 1918 it was 8,288,245 tons. Even since the war, when the production of the underground mines has shown no increase, the production of the strip mines has continued to grow by leaps and bounds. For the industry as a whole, the proportion of the output obtained by stripping is still small—3.8 per cent in 1929—but in some States of the Mississippi Valley it approaches 50 per cent.

The tonnage of Pennsylvania anthracite mined by stripping is much smaller. It increased rapidly from 1915 to 1918, since when it has shown no great change.

TABLE 50.—*Bituminous coal and anthracite mined by stripping operations of all types, 1914–1929*

[Note that coal stripped by horses, or in mines combining stripping and underground methods in the same operation, is included in this table]

Year	Bituminous coal			Pennsylvania anthracite			Total		
	Number of power shovels in use	Quantity mined by stripping		Number of power shovels in use	Quantity mined by stripping		Number of power shovels in use	Quantity mined by stripping	
		Net tons	Per cent of total output		Net tons	Per cent of fresh-mined output		Net tons	Per cent of total output
1914	48	1,280,946	0.3	(1)	(1)	(1)	(1)	(1)	(1)
1915	87	2,831,619	.6	57	1,121,603	(1)	144	3,953,222	0.7
1916	111	[2] 3,932,395	.8	105	1,987,800	1.4	216	[2] 5,920,195	1.0
1917	182	5,789,977	1.0	76	2,301,588	2.5	258	8,091,565	1.2
1918	276	8,288,245	1.4	82	2,360,183	2.6	358	10,648,428	1.6
1919	287	5,634,951	1.2	89	2,006,879	2.4	376	7,641,830	1.4
1920	312	8,859,553	1.5	96	2,054,441	2.5	408	10,913,994	1.7
1921	279	5,057,483	1.2	85	2,027,790	2.3	364	7,085,273	1.4
1922	379	10,208,884	2.4	69	949,745	1.9	448	11,158,629	2.4
1923	442	11,940,134	2.1	95	2,263,098	2.7	537	14,203,232	2.2
1924	420	13,606,954	2.8	95	1,865,677	2.2	515	15,472,631	2.7
1925	389	16,870,907	3.2	97	1,578,478	2.7	486	18,449,385	3.2
1926	410	16,922,695	3.0	99	2,401,356	3.0	509	19,324,051	3.0
1927	455	18,378,166	3.6	112	2,153,156	2.8	567	20,531,322	3.5
1928	415	19,788,577	4.0	108	2,422,924	3.4	523	22,211,501	3.9
1929	411	20,268,099	3.8	98	1,911,766	2.7	509	22,179,865	3.7

(1) Not available.

[2] Revised figures.

POWER STRIP PITS PROPER

Of the 20,268,099 tons of bituminous coal and lignite recovered by stripping in 1929, approximately 29,000 tons was obtained by small horse-stripping operations, 472,000 tons by mines combining stripping and underground methods, and 19,767,000 tons by power strip pits proper. The horse-stripping operations have local importance only. The combination strip and underground operations are confined to a few special locations, chiefly in Pennsylvania and Alabama. The tendencies of strip mining can be studied much better in the record of the power strip pits proper, which is shown separately in Tables 51 and 52.

The causes of the rapid increase in the tonnage of soft coal obtained by stripping are fully discussed in a special study entitled "The Economics of Strip Coal Mining," by O. E. Kiessling, F. G. Tryon, and L. Mann, published as Bureau of Mines Economic Paper 11.

Among the subjects treated are the rapid growth of strip mining, postwar trends of wages and other costs, improvements in operating efficiency, improvements in quality of product, working time at strip mines, ratio of overburden to coal, and prospects for future expansion. The paper has been distributed to producers of strip coal. Additional copies may be obtained from the Superintendent of Documents, Washington, D. C., price 10 cents.

TABLE 51.—*Summary of operations of power strip pits proper in the bituminous-coal fields, by States, in 1929*

[Corresponding figures for each year from 1914 to 1928 are given in Bureau of Mines Economic Paper 11, pp. 27–32]

State	Number of strip pits	Number of power shovels	Amount mined by stripping, net tons [1]	Average value per ton [2]	Number of men employed [2]	Average number of days worked [2]	Average tons per man per day [2]
Power strip pits proper: [3]							
Alabama	9	17	312, 263	$1. 95	373	181	4. 8
Georgia	1	3	44, 636	3. 05	102	260	1. 7
Illinois	20	73	5, 336, 339	1. 57	1, 635	169	19. 3
Indiana	23	72	5, 610, 918	1. 42	1, 942	194	14. 9
Kansas	28	32	1, 018, 717	1. 99	610	143	11. 7
Kentucky	8	22	395, 669	1. 08	377	73	14. 4
Missouri	29	48	1, 986, 297	2. 08	964	159	12. 9
Montana	1	8	1, 218, 827	1. 50	136	347	25. 9
North Dakota	8	18	845, 971	1. 64	281	187	16. 1
Ohio	18	49	1, 670, 582	1. 13	811	154	13. 4
Oklahoma	9	18	488, 012	2. 44	468	166	6. 5
Pennsylvania	9	22	315, 068	1. 30	289	137	8. 0
Other States [4]	7	15	523, 478	1. 13	269	163	11. 9
Total	170	397	19, 766, 777	1. 57	8, 257	170	14. 1
Horse-stripping operations	19	---------	29, 110	1. 86	63	121	3. 9
Mines combining stripping and underground methods in same operation [5]	11	14	472, 212	1. 99	916	254	6. 5
Grand total	200	411	20, 268, 099	1. 60	9, 236	178	13. 0

[1] Exclusive of coal produced by underground mining in the same operation.

[2] Items in these columns include underground mining conducted in the same operation.

[3] Includes a few operations in which a very small tonnage (never more than 10 per cent) was produced by underground methods. The total obtained by underground methods in this entire group was only 29,511 tons.

[4] Includes Arkansas, Tennessee, Texas, West Virginia, and Wyoming.

[5] Includes all operations in which 10 per cent or more of the output was obtained by underground methods (including 2 small operations without power shovels). In addition to the 472,212 tons produced by stripping, this group of 11 mines obtained 1,040,240 tons by underground methods, its total production by both methods being 1,512,452 tons.

TABLE 52.—*Progress of power strip pits proper in the bituminous-coal fields, 1914–1929*

[Note that horse or hand stripping pits and mines combining stripping and underground methods in the same operation are excluded from this table]

Year	Number of power strip pits	Number of power shovels	Mined by stripping, net tons	Average value per net ton, f. o. b. mines	Average number of days worked	Number of men employed	Average tons per man per day
1914	35	48	1, 280, 946	(1)	187	1, 355	5. 1
1915	60	87	2, 831, 619	$1. 18	199	2, 445	5. 9
1916	75	106	3, 880, 698	1. 51	194	3, 000	6. 7
1917	105	155	5, 483, 957	2. 34	171	4, 916	6. 6
1918	138	239	7, 948, 844	2. 54	196	5, 961	7. 0
1919	145	256	5, 386, 478	2. 33	154	5, 628	6. 4
1920	141	268	8, 175, 595	4. 12	184	6, 167	7. 2
1921	125	240	4, 606, 239	2. 87	112	4, 961	8. 3
1922	189	340	9, 298, 485	3. 07	143	8, 044	8. 1
1923	197	380	11, 087, 157	2. 31	140	8, 490	9. 3
1924	189	389	13, 183, 982	2. 00	154	8, 644	9. 9
1925	179	363	16, 497, 260	1. 84	175	8, 430	11. 2
1926	183	375	16, 082, 633	1. 89	171	8, 452	11. 2
1927	207	424	17, 867, 253	1. 90	177	9, 131	11. 0
1928	176	385	19, 130, 934	1. 69	180	8, 162	13. 0
1929	170	397	19, 766, 777	1. 57	170	8, 257	14. 1

[1] Not available.

LOADING MACHINES AND CONVEYORS

Summary.—From 21,559,000 tons in 1928 the production of bituminous coal by mechanized mining increased to 37,862,000 tons in 1929—a growth of more than 75 per cent.

Practically all phases of technological improvement in mining, such as cutting machines and electric haulage, are forms of mechanization. The discussion of mechanization now going on in the American coal industry, however, centers around the use of mechanical devices to reduce the labor of hand shoveling into mine cars. How far the replacement of hand loading had progressed by the end of 1929 is shown in a special study by members of the bureau,[15] the results of which are summarized in Tables 53 to 58.

The figures are based on information courteously furnished by the operators in their customary statistical reports to the bureau. Each operator reported the number and types of machines and the tonnage loaded by each type. To make sure that every mine using mechanical loading devices was included in the survey, manufacturers of equipment were asked for lists of the mining companies to whom machines had been shipped, and these lists were then checked with the operators' reports to the bureau.

The tonnage of bituminous coal produced by mechanized mining in 1929 is summarized in Table 53. The total of 37,862,000 tons relates only to operations underground. It does not include coal loaded by power shovels in strip pits, which amounted to approximately 20,239,000 tons in 1929. Neither does it include anthracite, 3,427,000 net tons of which were loaded mechanically in 1929, according to the Pennsylvania Department of Mines.

It should also be noted that the figures in Table 53 represent production and not capacity. The total is undoubtedly much less than the annual capacity of the machines installed up to the end of 1929, partly because production seldom reaches theoretical capacity. Many of the machines used in 1929 were installed late in the year and so had little effect on the tonnage for 1929; therefore, the production by mechanical methods in 1930 will undoubtedly show an increase over that in 1929.

As shown by the top section of Table 53, the total loaded by machines was 19,291,000 tons. This includes coal handled by all types of machines that eliminate hand shoveling, except for incidental clean-up. Of the total, mobile loading machines (including entry drivers) handled 16,432,000 tons, scrapers (including a small tonnage handled by scows) handled 1,550,000 tons, and self-loading conveyors (including shakers provided with duckbills, conveyors equipped with a cutting device, and certain others designed to receive the coal as shot down) accounted for 1,309,000 tons.

The data in the middle section of Table 53 cover conveyors. Including duckbills and other self-loading conveyors, the total quantity handled by conveyors was 19,880,000 tons. Of this amount, hand-loaded conveyors accounted for 3,592,000 tons and pit-car loaders for 14,979,000 tons. While the pit-car loader is often locally referred to simply as a conveyor, in the bureau's reports the latter term is reserved for devices that transport the coal for an appreciable distance.

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[15] Kiessling, O. E., Tryon, F. G., and Mann, L., Preliminary Report on Loading Machines and Conveyors in Bituminous-Coal Mines in 1929: Min. Cong. Jour., July, 1930, pp. 15–17.

From the recapitulation at the bottom of the table it will be seen that of the total tonnage handled mechanically, 43.4 per cent was loaded by mobile loading machines, 4.1 per cent by scraper loaders, 39.6 per cent by pit-car loaders, and 12.9 per cent by conveyors (including duckbills).

Table 53.—*Tonnage of bituminous coal produced by mechanized mining in 1929*

	Net tons	Per cent
Loaded by machine:		
Mobile loading machines	16,432,000	85.2
Scraper loaders	1,550,000	8.0
Duckbills and other self-loading conveyors	1,309,000	6.8
Total loaded by machine	19,291,000	100.0
Handled by conveyors:		
Duckbills and other self-loading conveyors	1,309,000	6.6
Pit-car loaders	14,979,000	75.3
Other hand-loaded conveyors	3,592,000	18.1
Total handled by conveyors	19,880,000	100.0
Recapitulation, less duplications:		
Mobile loading machines	16,432,000	43.4
Scrapers	1,550,000	4.1
Pit-car loaders	14,979,000	39.6
Conveyors, including duckbills	4,901,000	12.9
Grand total, mechanized mining	37,862,000	100.0

Increase by types of machines, 1928–1929.—In comparison with 1928 the total mechanized tonnage increased more than 75 per cent. Table 54 shows which types of machines have contributed most of this increase. The tonnage handled by mobile loading machines increased 39.1 per cent. Scrapers barely held their own, while the tonnage handled by duckbills (including other types of self-loading conveyors) increased 9.1 per cent. The figure given under "duckbills and other self-loading conveyors" is a composite; because of the necessity for so combining the data, a substantial increase in tonnage handled by duckbills is partly offset by the declining importance of other types of self-loading conveyors.

The greatly extended use of pit-car loaders has been surprising. From only 523,000 tons handled by pit-car loaders in 1926, the tonnage increased to 4,117,000 tons in 1928. In 1929, however, pit-car loaders accounted for 14,979,000 tons, a gain of 263.8 per cent over the preceding year.

For the first time comparative figures are presented in Table 54 of the tonnage loaded by hand-loaded face conveyors over a 2-year period. From 1928 to 1929, the quantity handled by this type of equipment increased 709,000 tons or 24.6 per cent.

TABLE 54.—*Comparative increase in tonnage handled by the principal types of machines, 1928 and 1929*

	1928 (net tons)	1929 (net tons)	Increase	
			Net tons	Per cent
Mobile loading machines	11, 811, 000	16, 432, 000	+4, 621, 000	+39. 1
Scraper loaders	1, 548, 000	1, 550, 000	+2, 000	+. 1
Duckbills and other self-loading conveyors	1, 200, 000	1, 309, 000	+109, 000	+9. 1
Total loaded by machines	14, 559, 000	19, 291, 000	+4, 732, 000	+32. 5
Pit-car loaders	4, 117, 000	14, 979, 000	+10, 862, 000	+263. 8
Other hand-loaded conveyors	2, 883, 000	3, 592, 000	+709, 000	+24. 6
Grand total mechanized	21, 559, 000	37, 862, 000	+16, 303, 000	+75. 6

Increase by types of machines, 1926–1929.—The trends in tonnage handled by the principal types of machines over the past four years are well illustrated in Figure 49. The steady rise in mobile loading machines is shown by the upper curve. Pit-car loaders, however, are to-day running mobile loading machines a close second, due particularly to the rapid rise of the former between 1928 and 1929. Duckbills and other self-loading conveyors have been increasing, but at a slower rate. Scrapers have just about held their own, decreasing between 1926 and 1928 but showing a slight gain in 1929. Hand-loaded face conveyors have made notable gains, as shown by the curve for the 2-year period, 1928–1929.

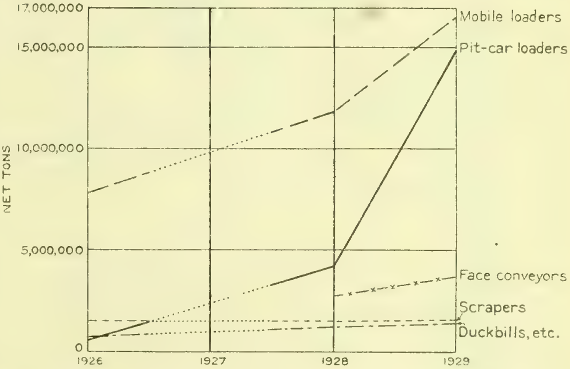

FIGURE 49.—Increase in tonnage of bituminous coal mechanically loaded, classified by types of machines, 1926–1929

For loading machines proper, the comparison may be carried back to 1923. The tonnage loaded by mobile machines, scrapers, and duckbills and other self-loading conveyors has been as follows:

	Net tons		Net tons
1923	1, 880, 000	1926	10, 022, 000
1924	3, 496, 000	1928	14, 559, 000
1925	6, 148, 000	1929	19, 291, 000

Accurate figures on pit-car loaders are not available prior to 1926, and data on the tonnage handled by hand-loaded face conveyors were obtained for the first time in 1928.

Distribution of pit-car loaders.—The rapid rise of pit-car loaders has already been mentioned. Figure 50 shows the distribution of this type of equipment throughout the various coal fields. It will be noted that pit-car loaders are used over a surprisingly wide area but that the principal concentration occurs in the thick coals of Illinois and Indiana and in the Pittsburgh bed of southwestern Pennsylvania.

They have made a vigorous start in western Kentucky, also, and there are a few in the Rocky Mountain States.

Distribution of hand-loaded face conveyors.—The regions in which pit-car loaders have made small headway have frequently installed face conveyors, and it is interesting to note how closely these types of equipment (both of which require a certain amount of hand shoveling) complement each other. As shown in Figure 51, hand-loaded face conveyors are noticeably absent in Illinois, Indiana, and in the Pittsburgh bed. On the other hand, they are used extensively along the eastern fringe of the Appalachian fields, from Alabama northward, with an unusually heavy concentration in the Cambria and Somerset areas of central Pennsylvania. In the West, face conveyors are commonly used in the Roslyn field of Kittitas County, Wash.

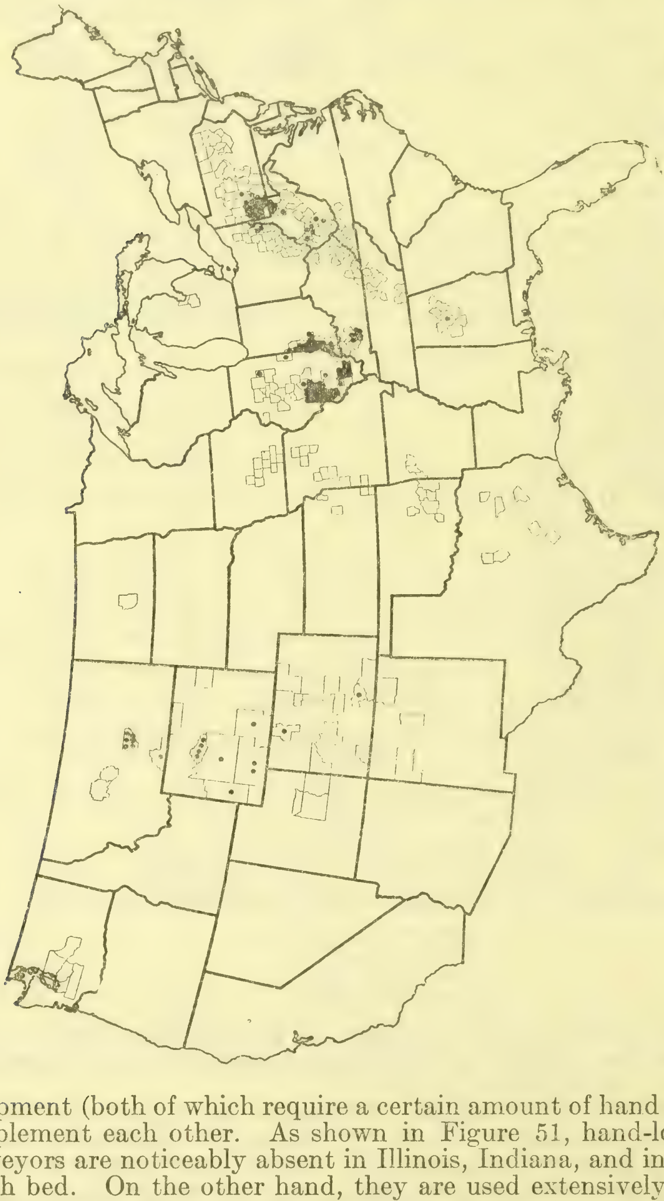

FIGURE 50.—Tonnage of bituminous coal handled on pit-car loaders in 1929. The map shows in outline all the important coal-producing counties. In any county from which operators reported tonnage loaded on pit-car loaders there is at least one dot no matter how small the quantity. A large number of dots indicates a larger tonnage and in some cases the number of dots is so great that the county appears solid black

Increase in mechanical loading, by States.—Relative gains in mechanical mining were widespread in 1929, and each of the principal States showed an increase over the preceding year. Table 55 traces the growth in each of the important States for the 2-year period and covers all types of loading equipment, including pit-car loaders and hand-loaded face conveyors. As a group, the Northern States show the largest increase, with the gain of 161.8 per cent in Illinois, due mainly to the increased use of pit-car loaders, heading the list. For Indiana and Pennsylvania the increases were 35 per cent and 57.9 per cent, respectively.

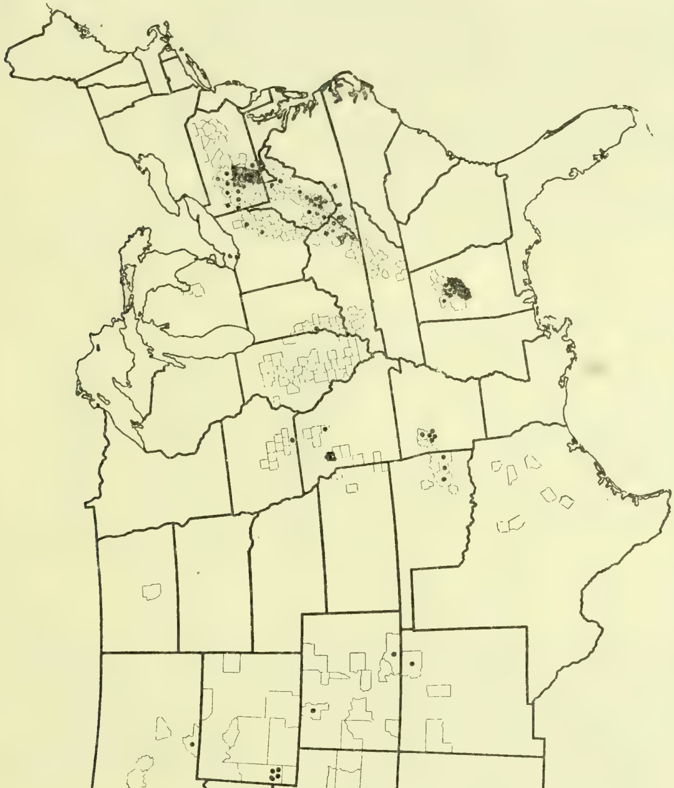

FIGURE 51.—Tonnage of bituminous coal handled on hand-loaded conveyors in 1929. The form of presentation is the same as in the preceding diagram. The areas of greatest concentration are along the eastern edge of the Appalachian fields, particularly in Alabama and in the Cambria and Somerset areas of central Pennsylvania. In the far West, the heaviest concentration appears in the Roslyn field of Kittitas County, Wash.

With the exception of the large gain of 92.9 per cent for Montana the Western States did not show a continuation of the same rate of growth that characterized the period from 1926 to 1928. Each of the

Southern States listed showed a notable increase, which ranged from 23.2 per cent in West Virginia to 52.1 per cent in Alabama, although the proportion of the total output mechanically loaded in any one of these States is still small.

At this point it should be noted that "Other States" includes a considerable tonnage mechanically loaded in Ohio. This coal is produced by a limited number of companies that load a large proportion of their output mechanically. Until such a time as it is advisable to show this figure separately, it is necessarily included with the tonnage from "Other States." Out of fairness to the coal industry of Ohio, however, one should not overlook the fact that mechanization has made considerable progress in the mines of that State.

TABLE 55.—*Increase in total tonnage mechanically mined, 1928 and 1929*

State	1928	1929	Increase	
			Net tons	Per cent
Illinois	6,971,000	18,252,000	11,281,000	161.8
Indiana	2,426,000	3,274,000	848,000	35.0
Pennsylvania	2,682,000	4,234,000	1,552,000	57.9
Wyoming	2,682,000	3,002,000	320,000	11.9
Utah	878,000	920,000	42,000	4.8
Montana	367,000	708,000	341,000	92.9
Kentucky	598,000	812,000	214,000	35.8
West Virginia	2,190,000	2,698,000	508,000	23.2
Virginia	[1] 794,000	984,000	190,000	23.9
Alabama	614,000	934,000	320,000	52.1
Other States [2]	[1] 1,357,000	2,044,000	687,000	50.6
	21,559,000	37,862,000	16,303,000	75.6

[1] Revised figures.

[2] Ohio, Colorado, New Mexico, Arkansas, Tennessee, North Carolina, Oklahoma, and Washington.

Total production with all types of machines, by States.—The first two columns of Table 56 show the tonnage handled by loading machines proper and the tonnage shoveled by hand on pit-car loaders or conveyors. The last column gives the total produced with all types of machines. Illinois, with 18,252,000 tons, ranks first in the total tonnage mechanically mined, followed by Pennsylvania, Indiana, Wyoming, and West Virginia in the order named.

TABLE 56.—*Total tonnage produced by loading machines, pit-car loaders, and conveyors, by States, in 1929*

State	Loaded by machine	Handled on pit-car loaders and hand-loaded conveyors	Total produced by mechanized mining
Illinois	6,545,000	11,707,000	18,252,000
Pennsylvania	1,925,000	2,309,000	4,234,000
Indiana	2,000,000	1,274,000	3,274,000
Wyoming	2,647,000	355,000	3,002,000
West Virginia	2,049,000	649,000	2,698,000
Virginia	816,000	168,000	984,000
Alabama	107,000	827,000	934,000
Utah	920,000	------------	920,000
Kentucky	451,000	361,000	812,000
Montana	555,000	153,000	708,000
Other States	1,276,000	768,000	[1] 2,044,000
	19,291,000	18,571,000	37,862,000

[1] Ohio, Washington, Arkansas, Colorado, Missouri, New Mexico, Maryland, Tennessee, North Carolina, Oklahoma, and Iowa.

Rank of States in percentage of output mechanized.—As in immediately preceding years Wyoming leads all other States in the percentage of its total output produced by mechanized mining. Fully 45.3 per cent of the deep-mined output of Wyoming was mined mechanically, of which 39.9 per cent was loaded by machine and 5.4 per cent was handled on pit-car loaders or hand conveyors. Illinois ranked next with a total of 33 per cent mechanically mined, followed by Montana and Indiana with 32.3 per cent and 25.7 per cent, respectively. In Utah, 17.8 per cent of the deep-mined output in 1929 was loaded by machine.

In the Appalachian and southern fields the percentage mechanically mined was much smaller. In Virginia, for example, it was 7.7 per cent; in Pennsylvania, 3 per cent; and in Kentucky, 1.4 per cent.

For the country as a whole the percentage of the deep-mined output mechanically mined was 7.4 per cent in 1929, as against 4.5 per cent in the preceding year.

TABLE 57.—*Rank of States in percentage of total bituminous deep-mined output produced by mechanized mining in 1929*

State	Percentage loaded by machine	Percentage handled on pit-car loaders and hand-loaded conveyors	Total percentage mined mechanically
Wyoming	39.9	5.4	45.3
Illinois	11.8	21.2	33.0
Montana	25.3	7.0	32.3
Indiana	15.7	10.0	25.7
Utah	17.8	----------	17.8
Virginia	6.4	1.3	7.7
Alabama	.6	4.7	5.3
Pennsylvania	1.4	1.6	3.0
West Virginia	1.5	.5	2.0
Kentucky	.8	.6	1.4
United States	3.8	3.6	7.4

Number of machines in use.—The total number of machine-loading devices in use in 1929 was 713, of which 488 were mobile loading machines, 126 were scrapers, and 99 were duckbills or other self-loading conveyors. These figures do not include machines used for experimental purposes only, or machines installed in mines that were idle throughout the year.

The total number of pit-car loaders in use during 1929 was 2,521, and conveyors (other than pit-car loaders) were used in 130 mines.

Mechanical loading and engineering progress.—The present extent of mechanical loading is not in itself an adequate index of the use of machinery in American coal mines. The commercial application of the loading machine is a recent development and represents only one phase of the broad technological progress that has characterized the art of coal mining in the past 15 years. This period has witnessed the rapid electrification of mine power and haulage and a great increase in the use of cutting machines. Corresponding advances have been made in preparation practice on the surface. Machine loading has been a relatively recent step in the general trend. The net result of the changes is seen in the increasing output per worker. In 1929 the production per man per day averaged 4.85 tons, an increase of 1.24 tons or 34 per cent in the 15 years since 1913. In the 15 years before 1913 the increase was only 0.52 ton.

TABLE 58.—*Mechanical loading underground in bituminous-coal mines, by States, in 1929*

State	Number of mines				Number of machines					Net tons mechanically mined			Total production of mechanized mines, in net tons			
	Using loading machines only (including scrapers, duckbills, etc.)	Using conveyors only (that is, pit-car loaders and hand-loaded conveyors)	Using both loading machines and conveyors	Total, less duplications	Mobile loading machines	Scrapers	Duck-bills and other self-loading conveyors	Pit-car loaders	Installations of hand-loaded conveyors [1]	Loaded by machine	Handled by pit-car loaders and hand-loaded conveyors	Total	Mines using loading machines only (including scrapers, duckbills, etc.)	Mines using conveyors only (that is, pit-car loaders and hand-loaded conveyors)	Mines using both loading machines and conveyors	Total, less duplications
Alabama	2	10		12	(2)	(2)		(2)	9	(2)	(2)	933, 664	(2)	(2)		3, 360, 240
Arkansas	6	10		16		(2)			10	(2)	(2)	187, 377	(2)	(2)		217, 403
Colorado	2	6	2	10	(2)		(2)	17	4	89, 988	57, 526	147, 514	253, 255	776, 650	206, 759	1, 236, 664
Illinois	12	44	17	73	215	(2)		1, 885		6, 544, 469	11, 707, 564	18, 252, 033	6, 016, 313	13, 620, 399	10, 005, 056	29, 641, 768
Indiana	7	15	4	26	64			163	1	1, 999, 686	1, 274, 309	3, 273, 995	982, 760	1, 829, 374	1, 202, 900	4, 015, 034
Iowa		1		1					1		(2)	(2)		(2)		(2)
Kentucky	8	10	3	21	11	(2)	(2)	34	9	450, 728	361, 536	812, 264	2, 522, 678	3, 020, 458	889, 477	6, 432, 613
Maryland		2		2					2		(2)	(2)		(2)		(2)
Missouri		4		4					4		126, 176	126, 176		161, 339		161, 339
Montana	3	4	1	8	17		(2)	23	1	555, 292	152, 346	707, 638	626, 090	362, 194	617, 648	1, 605, 932
New Mexico	3	1		4		(2)			1	(2)	(2)	63, 379	(2)	(2)		611, 111
North Carolina	1			1		2				30, 000		30, 000	52, 180			52, 180
Ohio	3	4	1	8	(2)		(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Oklahoma		2	1	3			(2)		3	(2)	(2)	25, 730		(2)	(2)	121, 426
Pennsylvania	37	70	16	123	45	73	3	241	55	1, 925, 246	2, 309, 029	4, 234, 275	6, 001, 697	18, 617, 987	4, 896, 214	29, 515, 898
Tennessee	2			2		(2)				(2)		(2)	(2)			(2)
Utah	8			8	25	(2)				920, 273		920, 273	3, 249, 226			3, 249, 226
Virginia	5	6		11	14				6	816, 064	168, 350	984, 414	2, 837, 533	750, 295		3, 587, 828
Washington	1	4		5			(2)		(2)	(2)	(2)	273, 026	(2)	(2)		818, 492
West Virginia	21	26	3	50	40	10	(2)	66	15	2, 049, 368	648, 247	2, 697, 615	7, 400, 894	9, 096, 112	825, 138	17, 322, 144
Wyoming	6	7	11	24	32	(2)	74	60	3	2, 647, 389	354, 580	3, 001, 969	1, 119, 255	1, 138, 406	2, 938, 005	5, 195, 666
Undistributed					25	41	22	32	6	1, 262, 157	1, 411, 173	1, 190, 154	2, 524, 102	4, 546, 021	551, 376	2, 492, 827
	127	226	59	412	488	126	99	2, 521	130	19, 290, 660	18, 570, 836	37, 861, 496	33, 585, 983	53, 919, 235	22, 132, 573	109, 637, 791

[1] Number of mines in which hand-loaded conveyors (other than pit-car loaders) were used.

[2] Included under "Undistributed" to avoid disclosing individual operations.

SCREENING AND SIZING

Detailed statistics of sizes of coal shipped from each county were published in Coal in 1927, pages 384 to 394, and a general discussion of the subject appeared in an article by H. O. Rogers and F. G. Tryon, in Coal Age, January, 1929, pages 30 to 32. Statistics on the type of screening equipment used in each field were issued in a second article by the same authors in Coal Age, August, 1929, pages 475 to 478.

MECHANICAL CLEANING

Tonnage cleaned by wet and pneumatic methods.—A new record in tonnage of bituminous coal cleaned mechanically was established in 1929. The total quantity of clean coal obtained by wet washing and pneumatic cleaning was 37,143,000 tons, an increase of 29 per cent over the preceding year. Pneumatic cleaning increased 54.3 per cent, and wet washing of all types gained 25.2 per cent. Included in the wet-washing tonnage is a group of five central washeries operated by steel companies, which are shown separately because hitherto figures covering their output have not been available. Central washery plants located near the mines and operated by the mining companies are included under the heading "At the mines." The total tonnage mechanically cleaned is shown in Table 59, and the following analysis is abstracted from a special study by H. O. Rogers and F. G. Tryon to be published elsewhere.

TABLE 59.—*Bituminous coal mechanically cleaned by wet and pneumatic methods, 1928 and 1929*

	Net tons of clean coal		Per cent of increase
	1928	1929	
By wet methods:			
At the mines	[1] 21,188,911	26,772,000	26.3
At central washeries operated by consumers	[1] 3,807,943	4,527,000	18.9
Total wet	[1] 24,996,854	31,299,000	25.2
By pneumatic methods	3,786,185	5,844,000	54.3
Grand total	[1] 28,783,039	37,143,000	29.0

[1] Revised figures.

Source of information.—These figures are based on information courteously furnished by the bituminous-coal operators. To make sure that the list of washeries was complete, manufacturers of the newer types of cleaning equipment were asked to supply lists of the mining companies for which they had recently installed new plants.

The statistics do not include the very large tonnage of anthracite cleaned mechanically; moreover, Bradford breakers and spiral separators are not included, although both may properly be listed among devices for cleaning coal. Finally, the figures do not include the enormous tonnage of lump and egg bituminous coal picked by hand on picking tables; although not ordinarily referred to as mechanical cleaning this method is commonly accepted as the best way of removing impurities from the larger sizes of bituminous coal.

Types of washing equipment.—The tonnage handled by each of the principal types of washing equipment is shown in Table 60. Pneumatic methods accounted for 15.7 per cent and wet methods for 84.3 per cent of the grand total mechanically cleaned in 1929. Jigs were still the dominant type of wet method, contributing in 1929 over half of the total tonnage mechanically cleaned. Concentrating tables accounted for 3,660,000 tons and concentrating tables in combination with jigs for 746,000 tons. Next to jigs the largest single tonnage was contributed by the group "Launders and upward-current classifiers," which accounted for 7,103,000 tons of coal. This group includes a number of diverse types, such as the rheolaveur and the Menzies hydroseparator, also tub washers, which can not be shown separately without disclosing the different operations of individual manufacturers. The Chance sand-flotation process is also included with this group and, for the same reason, can not be classified separately. Most of the growth in recent years has occurred in "Launders and upward-current classifiers" and "Pneumatic processes."

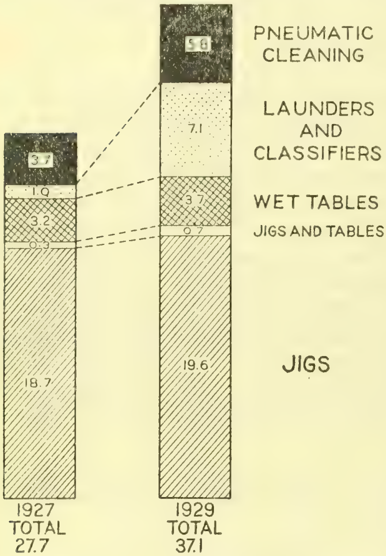

FIGURE 52.—Increase in tonnage of bituminous coal mechanically cleaned, classified by types of cleaning equipment, 1927–1929. Figures represent million tons of clean coal

It should be noted that the figures for cleaned coal obtained in 1929 are undoubtedly less than the capacity of the plants now installed. Many new plants did not begin to produce until late in the year and many others operated at less than capacity. The total production of all coal—cleaned and not cleaned—at mines provided with cleaning facilities is therefore shown in the last column of the table. It was found to be two or three times the production of cleaned coal proper, indicating a further large increase in cleaned coal during 1930.

The increase in tonnage cleaned by each of the principal types of equipment from 1927 to 1929 is shown in Figure 52.

TABLE 60.—*Bituminous coal mechanically cleaned, classified by type of washing equipment, in 1929*

[Note that central washeries operated by consumers are included]

	Number of plants	Cleaned coal		Total production at mines served by cleaning plants
		Net tons	Per cent	
Wet methods:				
Jigs	150	19,598,940	52.8	33,832,453
Jigs in combination with concentrating tables	9	746,185	2.0	1,062,212
Concentrating tables	14	3,659,976	9.9	6,721,855
Launders and upward-current classifiers [1]	55	7,103,086	19.1	21,481,489
Unspecified	9	190,808	.5	311,994
Total wet	237	31,298,995	84.3	63,410,003
Pneumatic methods	43	5,843,979	15.7	15,732,139
Grand total	280	37,142,974	100.0	[2] 74,606,590

[1] Includes rheolaveur and Chance processes.

[2] The total excludes duplications where the same mine is served by both wet and pneumatic methods.

Tonnage mechanically cleaned, by States.—Alabama led all other States, with a total of 13,586,000 tons cleaned mechanically in 1929. (See Table 61.) Pennsylvania, with 11,099,000 tons, was second; and West Virginia (including for statistical purposes Virginia), with 7,639,000 tons, was third. The development of pneumatic cleaning has been greatest in southern West Virginia and in Pennsylvania. Three other States reported production by pneumatic methods, but their tonnages can not be shown.

TABLE 61.—*Bituminous coal mechanically cleaned by wet and pneumatic methods, by States, in 1929*

[Central washeries operated by consumers in Colorado and Pennsylvania are included]

State	Clean coal, net tons			Per cent of State output mechanically cleaned
	Wet methods	Pneumatic methods	Total	
Alabama	[1] 13,586,000	(1)	13,586,000	76.8
Arkansas and Montana	83,000	------------	83,000	1.6
Colorado	1,271,000	------------	1,271,000	12.8
Illinois and Indiana	[1] 1,025,000	(1)	1,025,000	1.3
Kentucky	[1] 802,000	(1)	802,000	1.3
Michigan and Ohio	362,000	------------	362,000	1.5
Pennsylvania	8,629,000	2,470,000	11,099,000	7.8
Tennessee	308,000	------------	308,000	5.4
Washington	968,000	------------	968,000	38.4
West Virginia and Virginia	4,426,000	3,213,000	7,639,000	5.1
	31,299,000	5,844,000	37,143,000	7.0

[1] To conceal individual operations the tonnage cleaned by pneumatic methods is combined with that by wet methods in Alabama, Illinois, and Kentucky.

Growth in tonnage washed, 1906–1929.—The long-time trend in washing is shown in Table 62. For coal washed at the mines the record can be carried back to 1907, in which year a total of 11,269,000 tons of cleaned coal was obtained, all by wet methods. (Figures were first collected in 1906, but the returns probably were incomplete.) For the next 10 years washing increased steadily, culminating in a peak of 25,484,000 tons in 1917. Thereafter, the tonnage cleaned by wet washing at the mines declined, and it was not until about 1924 that the decline was checked. Since then, active interest in preparation and the introduction of improved equipment, particularly in the group of launders and classifiers, has led to rapid expansion; and in 1929 the tonnage cleaned by wet washing at the mines rose to a new high record, exceeding by 1,288,000 tons the previous high mark of 1917. Pneumatic cleaning was first applied on a commercial scale in 1919 and since then has grown by leaps and bounds. As a result of the combined progress in wet and pneumatic methods the total tonnage washed at the mines now shows a very large increase over that in 1917.

TABLE 62.—*Growth of total tonnage of bituminous coal mechanically cleaned, 1906–1929, in net tons of clean coal*

[Data for central washeries operated by consumers are not available before 1927]

Year	Wet methods at mines (tons)	Pneumatic methods at mines (tons)	Total at mines (tons)	Per cent of national production	Washed at central plants operated by consumers	Grand total
1906	[1] 9,251,946	----------	[1] 9,251,946	2.7	No data.	No data.
1907	11,269,518	----------	11,269,518	2.9	No data.	No data.
1908	11,870,438	----------	11,870,438	3.6	No data.	No data.
1909	14,443,147	----------	14,443,147	3.8	No data.	No data.
1910	16,035,387	----------	16,035,387	3.8	No data.	No data.
1912	17,538,572	----------	17,538,572	3.9	No data.	No data.
1913	22,069,691	----------	22,069,691	4.6	No data.	No data.
1914	20,264,141	----------	20,264,141	4.8	No data.	No data.
1915	20,873,727	----------	20,873,727	4.7	No data.	No data.
1916	22,922,218	----------	22,922,218	4.6	No data.	No data.
1917	25,483,696	----------	25,483,696	4.6	No data.	No data.
1918	22,017,293	----------	22,017,293	3.8	No data.	No data.
1919	16,884,062	(2)	(2)	[3] 3.6	No data.	No data.
1920	17,984,289	(2)	(2)	[3] 3.3	No data.	No data.
1921	13,628,724	(2)	(2)	[3] 3.4	No data.	No data.
1923	20,140,385	(2)	(2)	[3] 3.8	No data.	No data.
1927	21,119,441	3,650,584	24,770,025	4.8	2,922,022	27,692,047
1928	[4] 21,188,911	3,786,185	[4] 24,975,096	5.0	[4] 3,807,943	[4] 28,783,039
1929	26,772,000	5,844,000	32,616,000	6.2	4,527,000	37,143,000

[1] Statistics on this subject were collected for the first time in 1906 and the figures for that year were probably not complete.

[2] Data on pneumatic cleaning, which began in 1919, are not available for 1919 to 1923. The tonnage in those years, however, was small.

[3] Includes an estimate for the tonnage cleaned pneumatically.

[4] Revised figures

Growth by States.—The change in tonnage washed becomes clearer when the record is viewed by States in Table 63. Because of the lack of data for the earlier years it is necessary to exclude the central washeries operated by steel companies. Alabama and the Virginias show a consistent increase back to the earliest record. On the other hand, Illinois increased rapidly from 1907 to 1917 and thereafter declined. Pennsylvania shows a large increase in the period before the World War, then a decline, and since 1927 a very large increase. Among other important washery States, Colorado and Washington recorded an increase up to 1917; a perceptible decline followed.

TABLE 63.—*Growth of bituminous coal mechanically cleaned at the mines by wet and pneumatic methods, by States, in 1907, 1913, 1917, 1927, and 1929, in net tons of clean coal*

[Note that central washeries operated by consumers in Colorado and Pennsylvania are excluded, because of lack of data in the early years]

State	1907	1913	1917	1927	1929
Alabama	3,750,418	7,210.588	11,408,051	13,153,643	13,586,000
Arkansas and Oklahoma	150,507	47,292	----------	14,896	10,000
Colorado, New Mexico and Montana	567,217	1,301,428	989,405	637,409	513,000
Georgia and Oregon	154,959	92,662	83,344	----------	----------
Illinois	2,465,767	3,664,928	4,651,154	560,642	527,000
Indiana	21,659	65,499	48,065	250,282	498,000
Kentucky	88,678	162,880	211,689	309,262	802,000
Maryland	9,856	----------	34,693	----------	----------
Michigan	----------	145,840	174,642	155,190	157,000
Missouri	72,227	118,681	37,617	----------	----------
Pennsylvania and Ohio	2,583,202	5,669,622	3,466,860	3,578,739	7,608,000
Tennessee	543.333	624,426	630,621	344,562	308,000
Texas	----------	21,761	23,817	----------	----------
Washington	644,501	1,343,120	1,475,529	820,481	968,000
West Virginia and Virginia	217,194	1,539,541	2,248,209	4,944,919	7,639,000
Other States	----------	61,423	----------	----------	----------
	11,269,518	22,069,691	25,483,696	24,770,025	32,616,000

Amount of refuse.—The total quantity of refuse removed in 1929 to produce the 37,143,000 tons of cleaned coal amounted to 3,442,000 tons; that is, of the total material treated by cleaning plants 8.5 per cent was refuse and 91.5 per cent marketable product.

Use of washed coal in the manufacture of coke.—The largest single outlet for washed coal is in the production of coke. Table 64 shows the consumption of washed coal by coke ovens over a long enough period to indicate the trend of demand. Details of the consumption in each State will be found in the bureau's annual reports on coke and by-products.

The exacting requirements of coke manufacture place a premium on washing in many localities where the coals possess the coking property but are too high in ash or in sulphur to be used without preliminary cleaning. Producers of coking coal were therefore among the pioneers in the development of the art of washing; and as early as 1890, when the statistical record begins, a considerable part of the coal made into coke was washed. From 7.1 per cent in 1890 the proportion of washed coal in the total charged rose to a high point of 23.7 per cent in 1906; since then it has declined slightly. In 1923 it stood at 16.6 per cent.

These figures purport to include all wet-washed coal, whether cleaned at the mine by the coal operator or at the ovens by the coke producer. Properly, they should also include coal cleaned by pneumatic processes. The questionnaire sent to the coke operators, however, has not specifically asked that pneumatically cleaned coal be reported as washed, and while it is clear that some operators did so report it others probably did not. Since about 1925, when the tonnage of pneumatically cleaned coal began to be significant, the figures of washed coal charged may not be complete. In future reports special efforts will be made to include pneumatically cleaned coal.

As it stands Table 64 shows a total of 12,509,683 tons of washed coal used in 1929, or 14.5 per cent of the total carbonized during the year.

TABLE 64.—*Washed coal used in the manufacture of by-product and beehive coke, 1890–1929*

[Figures include coal cleaned at central washeries operated by the consumer]

Year	Net tons of washed coal charged in—			Per cent of washed coal in total charged	Year	Net tons of washed coal charged in—			Per cent of washed coal in total charged
	By-product ovens	Beehive ovens	All ovens			By-product ovens	Beehive ovens	All ovens	
1890	------------	1,269,810	1,269,810	7.1	1910	(1)	(1)	13,691,925	21.7
1891	------------	1,143,766	1,143,766	7.0	1911	(1)	(1)	11,454,684	21.5
1892	------------	1,103,206	1,103,206	5.9	1912	(1)	(1)	12,349,724	18.9
1893	(1)	(1)	1,561,989	10.5	1913	(1)	(1)	13,714,297	19.8
1894	(1)	(1)	1,586,535	11.1	1914	3,196,997	7,619,607	10,816,604	21.0
1895	(1)	(1)	2,186,202	10.5	1915	4,936,286	8,321,426	13,257,712	21.4
1896	(1)	(1)	2,700,685	14.4	1916	5,161,921	10,741,349	15,903,270	19.5
1897	(1)	(1)	3,491,759	16.7	1917	5,564,270	9,954,865	15,519,135	18.5
1898	(1)	(1)	4,003,377	15.9	1918	5,925,529	9,653,531	15,579,051	18.3
1899	(1)	(1)	4,371,691	14.5	1919	5,065,463	6,532,744	11,598,207	17.7
1900	(1)	(1)	5,374,447	16.7	1920	7,540,827	5,882,864	13,423,691	17.6
1901	(1)	(1)	5,910,296	17.3	1921	5,011,786	1,127,842	6,139,628	16.5
1902	(1)	(1)	7,475,221	18.9	1922	6,929,251	2,154,569	9,083,820	16.7
1903	(1)	(1)	7,982,823	20.3	1923	9,517,935	4,519,916	14,037,851	16.6
1904	(1)	(1)	7,848,097	21.5	1924	8,804,495	2,928,806	11,733,301	18.1
1905	(1)	(1)	9,551,137	19.3	1925	8,990,936	2,641,048	11,631,984	15.6
1906	(1)	(1)	13,213,315	23.7	1926	10,007,268	2,690,848	12,698,116	15.3
1907	(1)	(1)	11,680,184	18.9	1927	8,866,424	1,503,666	10,370,090	13.9
1908	(1)	(1)	9,208,914	23.3	1928	10,580,065	1,190,621	11,770,686	15.3
1909	(1)	(1)	11,833,611	19.9	1929	11,014,461	1,495,222	12,509,683	14.5

[1] Separation between by-product and beehive not available before 1914.

CONSUMPTION, STOCKS, AND DISTRIBUTION

CONSUMPTION

Increasing interest in problems of coal marketing has led the bureau to develop a running analysis of the trend of coal consumption, which is published in the weekly coal reports. By consulting the index to those reports the reader will find monthly statistics of coal used by the principal classes of consumers in each of the nine trade regions of the country. The broader features of consumption are shown in Tables 65 to 67.

Total annual consumption.—Excluding exports and allowing for changes in stocks the total annual consumption of bituminous coal is now about 500,000,000 tons. (See Tables 3 and 66.) In the last decade it has fluctuated between a minimum of 392,000,000 tons in 1921, a year of acute industrial depression, and a maximum of 533,000,000 tons in 1926, when the demand was artificially stimulated by a strike of the anthracite miners. In 1928 the consumption was 498,828,000 tons, and in the boom year 1929 it was 519,555,000. A special analysis of consumption will be found in Coal in 1927, pages 404 to 427.

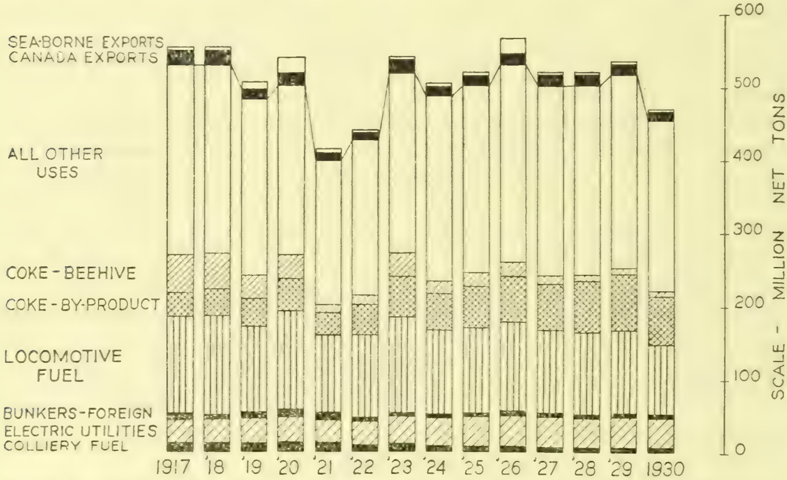

FIGURE 53.—Tonnage of bituminous coal absorbed by the principal branches of consumption, 1917–1930. The diagram shows that although there has been no great change in the aggregate consumption of bituminous coal during the past 14 years, shifts have occurred in many of the important uses. A marked decline has taken place in the consumption of colliery, bunker, and locomotive fuel, but these losses have been offset through increased consumption by the electric public utilities. The total quantity used for coke making at present is not greatly different from that in 1917, but the relative position of the beehive and by-product ovens has been reversed. In the group of "all other uses" a decline in manufacturing consumption has been offset by an increase in consumption for domestic use

Consumption by uses in a typical year.—A cross section of the demand in a typical year of moderate industrial activity is given in Table 65. The figures for each item are the latest available, and for several of the most important uses they represent the year 1929. For steel works and general manufacturing, however, 1927 was used. If the record for 1929 was available many of the manufacturing groups would show a somewhat higher rate of consumption. For still another item no data are available since 1919. The allowance of 102,000,000 tons for "Domestic and all other uses" is an estimate and may be increased upon receipt of later information. The composite result, although not agreeing exactly with the total consumption, is believed to be typical of conditions when general business is normal.

TABLE 65.—*Consumption of bituminous coal by uses in a typical year of industrial activity*

Item	Year	Net tons consumed		Per cent of total	
Railroad fuel (all steam roads)[1]	1929				
Locomotive fuel		118, 600, 000		23. 7	
All other (shops, stations, etc.)		12, 500, 000		2. 5	
Total			131, 100, 000		26. 2
Coke ovens	1929				
By-product		76, 759, 000		15. 4	
Beehive		10, 028, 000		2. 0	
Total			86, 787, 000		17. 4
Electric utilities	1929		42, 785, 000		8. 6
Steel works [2]	1927				
Gas coal		8, 300, 000		1. 6	
Steam coal		14, 309, 000		2. 9	
Total			22, 609, 000		4. 5
General manufacturing [3]	1927				
Stone, clay, and glass products		24, 155, 000		4. 8	
Metals and metal products other than steel [4]		14, 814, 000		3. 0	
Food products (not including ice)		11, 239, 000		2. 2	
Chemicals and fertilizers		9, 803, 000		2. 0	
Paper, pulp, and printing		9, 515, 000		1. 9	
Textiles and their products		7, 865, 000		1. 6	
Petroleum refining		3, 632, 000		. 7	
Leather and rubber products		3, 777, 000		. 8	
Lumber and wood products		3, 140, 000		. 6	
Miscellaneous manufacturing industries		2, 506, 000		. 5	
Ice		1, 604, 000		. 3	
Total			92, 050, 000		18. 4
Coal-gas and water-gas plants [5]	1927		6, 252, 000		1. 3
Coal-mine fuel	1929		4, 662, 000		. 9
Mines and quarries other than coal	1919		4, 190, 000		. 8
Bunker	1929				
Foreign		4, 287, 000		. 8	
Domestic (incomplete)		3, 407, 000		. 7	
Total			7, 694, 000		1. 5
Domestic and all other uses [6]			102, 000, 000		20. 4
Grand total			500, 129, 000		100. 0

[1] Based on records of Interstate Commerce Commission covering Class I roads. Includes allowance for Classes II and III, switching, and terminal companies.

[2] Total for iron blast furnaces, steel works, and rolling mills, as reported by Census of Manufactures and quarterly stock reports of Bureau of Mines.

[3] Other than steel, coke, gas, and railroad shops; from Census of Manufactures.

[4] Includes motor vehicles.

[5] Bituminous coal used for gas making and boiler fuel, not including that charged in by-product ovens operated by city gas companies.

[6] Includes heating large buildings other than factories, such as hotels, apartments, stores, offices, theaters, garages, and service stations; also, a number of other items that can not be separated, such as waterworks, construction industry, threshing, public institutions, central heating plants, laundries, and very small industrial consumers not covered by the Census of Manufactures. Because of inclusion of these items, the total for this group is not comparable with estimates of consumption for "domestic use" hitherto published.

Long-time trend of consumption.—As already pointed out (p. 695), the former rapid growth of the demand for coal has been checked in recent years by advances in fuel economy; by competition of oil, gas, and water power; and by other factors. Table 66 shows the consumption of bituminous coal in each year since 1917, subdivided according to uses, as far as the available records permit. Information on several other classes of consumers is obtainable for certain census years, but the items shown are selected because they are reported each year in exactly comparable form. The known items are consumption for colliery fuel, electric-power generation, bunker fuel for ships in foreign trade, locomotive fuel on Class I roads, and manufacture of beehive and by-product coke. By subtracting these known items from the calculated total consumption, the total for "All other uses" is obtained. This covers consumption in manufacturing and for domestic and miscellaneous other purposes.

The changes from year to year are shown graphically in Figure 53.

TABLE 66.—*Changes in the United States consumption of bituminous coal by such classes of consumers as report currently, and by all other consumers, 1917–1929, in thousands of net tons*

[Information on several other classes of consumers is available for certain years. The items shown in this table are selected because they are available in strictly comparable form for each year]

Year	Consumed in the United States								Exported		Total of consumption and exports [7]
	Colliery fuel	Electric public utilities [1]	Bunkers, foreign trade [2]	Locomotive fuel, Class I roads [3]	Coke beehive ovens [4]	Coke by-product ovens [4]	All other uses [5]	Total consumption [6]	To Canada and Mexico	To all other countries	
1917	12, 117	[8] 33, 500	7, 709	133, 421	52, 247	31, 506	258, 909	529, 409	18, 327	5, 512	553, 248
1918	12, 521	[8] 34, 500	6, 189	134, 214	48, 160	36, 868	258, 141	530, 593	18, 316	4, 034	552, 943
1919	11, 062	[8] 35, 100	8, 224	119, 692	29, 730	35, 857	241, 993	481, 658	12, 064	8, 050	501, 772
1920	11, 896	37, 124	10, 486	135, 414	31, 986	44, 205	237, 484	508, 595	16, 458	22, 059	547, 112
1921	9, 123	31, 585	8, 453	107, 910	8, 475	28, 713	197, 590	391, 849	13, 590	9, 541	414, 980
1922	7, 831	34, 179	4, 615	113, 163	13, 286	41, 053	212, 788	426, 915	10, 938	1, 475	439, 328
1923	8, 765	38, 966	5, 093	131, 492	30, 084	54, 276	250, 317	518, 993	16, 960	4, 494	540, 447
1924	6, 618	37, 556	4, 460	117, 247	15, 914	49, 061	253, 148	484, 004	12, 746	4, 354	501, 104
1925	5, 776	40, 222	4, 866	117, 714	17, 423	57, 110	256, 082	499, 193	13, 547	3, 915	516, 655
1926	5, 728	41, 311	7, 736	122, 823	19, 225	63, 647	272. 111	532. 581	13, 762	21, 510	567, 853
1927	4, 930	41, 888	4, 565	115, 883	11, 208	63, 240	258, 087	499, 801	14, 724	3, 288	517, 813
1928	4, 602	41, 350	4, 294	112, 382	7, 018	70, 166	259, 016	498, 828	14, 050	2, 114	514, 992
1929	4, 663	44, 937	4, 287	113, 894	10, 028	76, 759	264, 987	519, 555	14, 727	2, 702	536, 984

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[1] United States Geological Survey. Includes a small amount of anthracite.

[2] Bureau of Foreign and Domestic Commerce.

[3] Interstate Commerce Commission. Note that consumption in shops, roundhouses, and stations is excluded, also the entire consumption of Class II and III roads.

[4] United States Bureau of Mines.

[5] Obtained by subtracting the known items from the total consumption. Includes general manufacturing, domestic, and many miscellaneous uses. From other sources it is known that consumption in steel works and general manufacturing is decreasing and that consumption for domestic uses is increasing.

[6] Production plus imports minus exports, plus or minus changes in consumers' stocks, as calculated in Table 3.

[7] Note that consumption includes the small amount imported.

[8] Estimated from 1917 Census of Electric Industries and incomplete data.

Consumption in each State.—Statistics of bituminous-coal consumption by States were published in Coal in 1917, part B, page 1254, and in Coal in 1918, part B, page 1366. Complete figures for all uses are not available by States for any later year; but certain larger items, such as coal charged in coke ovens, have been measured as recently as 1929. Table 67 assembles the latest information available concerning each item. For the very important item of consumption for domestic purposes no data by States have been collected since 1917 and for the consumption of mines and quarries none since 1919. Manufacturing (other than coke) is represented in the table by 1927.

The total consumption accounted for is 327,000,000 tons. This amount does not include railway and steamship fuel, which can not be apportioned by States, or a number of other items for which no data are available, such as waterworks, threshing engines, the construction industry, small manufacturing plants whose annual product is worth less than $5,000, custom gristmills and sawmills, power laundries, garages and service stations, and the heating of many large buildings.

TABLE 67.—*Bituminous coal consumed by States, in net tons*

[Railway fuel and bunker fuel for steam vessels not included in this table]

State	Used at coal mines for steam and heat, 1929	Consumed in manufactures other than coke plants, 1927 [1]	Consumed in the manufacture of by-product coke, 1929	Consumed in the manufacture of bee-hive coke, 1929	Consumed in electric utility power plants, 1929 [2]	Consumed for domestic purposes, 1917	Consumed in mines and quarries other than bituminous-coal mines, 1919 [2]	Total consumption accounted for
Alabama	166, 799	1, 819, 168	6, 708, 774		26, 896	651, 000	251, 453	9, 624, 090
Arizona	72	205, 242				65, 000	85, 230	355, 544
Arkansas	9, 515	125, 331			93, 047	300, 000	15, 260	543, 153
California		33, 155				355, 000	1, 988	390, 143
Colorado	183, 746	1, 551, 746	830, 748	237, 926	420, 093	1, 450, 000	126, 417	4, 800, 676
Delaware		417, 062			53, 805	20, 000	2, 543	493, 410
District of Columbia		72, 989			343, 243	250, 000		666, 232
Florida		136, 824			24, 455	90, 000	32, 688	283, 967
Georgia	257	1, 174, 577			18, 162	871, 000	55, 354	2, 119, 350
Idaho		140, 432				300, 000	17, 395	457, 827
Illinois	953, 932	13, 479, 339	5, 984, 119		6, 219, 737	9, 721, 000	145, 848	36, 503, 975
Indiana	326, 235	9, 229, 284	8, 748, 928		2, 525, 373	3, 500, 000	75, 122	24, 404, 942
Iowa	57, 239	2, 200, 444			961, 253	2, 912, 000	26, 734	6, 157, 670
Kansas	88, 564	827, 404			361, 733	1, 800, 000	42, 862	3, 120, 563
Kentucky	477, 338	2, 057, 107	(4)		551, 555	1, 864, 000	45, 158	4, 995, 158
Louisiana		558, 787			4, 011	370, 000		932, 798
Maryland	11, 193	1, 521, 145	1, 914, 048		551, 644	352, 000	21, 565	4, 371, 595
Michigan	49, 627	10, 181, 956	3, 760, 441		2, 444, 616	2, 974, 000	1, 293, 545	20, 704, 185
Minnesota		1, 655, 601	1, 062, 179		546, 116	2, 637, 000	738, 750	6, 639, 646
Mississippi		461, 620			72, 806	300, 000		834, 426
Missouri	64, 428	3, 405, 299	(4)		1, 220, 470	3, 000, 000	345, 425	8, 035, 622
Montana	47, 831	448, 188			11, 306	885, 000	166, 483	1, 558, 808
Nebraska		674, 074			541, 654	1, 425, 000	1, 834	2, 642, 562
Nevada		213, 638				100, 000	113, 862	427, 500
New England:								
Maine		1, 026, 659			4, 258	[5] 1, 655, 000	9, 586	[5] 15, 324, 509
New Hampshire		531, 783			68, 650		5, 027	
Vermont		179, 393			814		24, 886	
Massachusetts		4, 092, 640	[5] 1, 809, 883		1, 710, 530		22, 871	
Connecticut		2, 210, 172			989, 040		11, 691	
Rhode Island		600, 688			364, 622		6, 316	
New Jersey		4, 609, 117	1, 248, 662		1, 368, 884	90, 000	62, 486	7, 379, 149
New Mexico	56, 570	94, 115			37, 794	175, 000	189, 732	553, 211
New York		10, 052, 837	6, 183, 918		6, 475, 143	1, 242, 000	82, 852	24, 036, 750
North Carolina	2, 700	1, 336, 172			186, 315	820, 000	41, 239	2, 386, 426
North Dakota	38, 502	156, 588			272, 835	655, 000		1, 122, 925
Ohio	139, 911	17, 922, 205	12, 316, 686	(4)	4, 826, 858	4, 900, 000	188, 026	40, 293, 686
Oklahoma	46, 339	273, 864			453, 559	775, 000	105, 272	1, 654, 034

Oregon	260	59, 123				225, 000	411	284, 794
Pennsylvania	1, 095, 730	22, 112, 723	21, 643, 559	8, 121, 032	4, 082, 906	1, 836, 000	269, 927	59, 161, 877
South Carolina		795, 331			127, 531	480, 000	18, 949	1, 421, 811
South Dakota		138, 265			126, 288	570, 000	43, 083	877, 636
Tennessee	55, 001	2, 145, 170	160, 842	169, 385	216, 440	1, 211, 000	157, 427	4, 115, 265
Texas	14, 237	379, 506			677, 384	650, 000	14, 190	1, 735, 317
Utah	16, 678	483, 870	493, 945	23, 361	94, 115	815, 000	115, 917	2, 042, 886
Virginia	41, 244	1, 926, 603		527, 280	765, 378	906, 000	96, 840	4, 263, 345
Washington	33, 342	538, 330	65, 845	34, 894	97, 402	650, 000	24, 616	1, 444, 429
West Virginia	497, 087	2, 907, 318	2, 056, 475	839, 142	1, 752, 241	475, 000	33, 377	8, 560, 640
Wisconsin		5, 055, 291	(4)		975, 596	2, 532, 000	59, 518	8, 622, 405
Wyoming	187, 597	115, 513			118, 553	250, 000	19, 563	691, 226
Total	4, 661, 974	132, 333, 688	74, 989, 052	9, 953, 020	42, 785, 111	57, 104, 000	5, 209, 318	327, 036, 163

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[1] Census of Manufactures, 1927. From the census figures the quantity of coal used in making coke has been deducted, as shown in Mineral Resources.

[2] From report of Division of Power Resources, United States Geological Survey.

[3] Fourteenth Census, Vol. II. From the census figures on total quantities of bituminous coal consumed by mines and quarries have been deducted the census figures on quantities consumed by bituminous-coal mines.

[4] Coal used in manufacture of coke from Census of Manufactures, 1927, included in column 2.

[5] Total for New England. Consumption by individual States can not be shown.

FUEL ECONOMY

No factor has had greater influence in checking the former growth of coal demand than the remarkable advances in efficiency of fuel utilization. (See Tables 68 to 72.) The history of the steam engine is a record of successive economies in fuel consumption, but it is clear that improvement in general practice has been especially rapid in the decade following the World War. In that period the average consumption of locomotive fuel per ton-mile has been reduced 26.5 per cent, and the average consumption of coking coal per ton of pig iron has been reduced 16.6 per cent. The greatest savings of all have been made by the public utilities in the generation of electric power. The average consumption per kilowatt-hour declined from 3.2 pounds in 1919 to 1.68 pounds in 1929, a saving in 10 years of 47.5 per cent.

It is generally admitted that the present rate of advance in fuel efficiency can not continue indefinitely. The progress since the war has been largely a taking up of slack, a general application of practices already in use at the better plants. Nevertheless, there is no sign that the advance will terminate abruptly. All branches of consumption shown in Tables 68 to 72 achieved fresh savings in 1929, and there is much room for further improvement merely in bringing average practice nearer to the level of what the best plants have already demonstrated to be possible.

The subject is discussed more fully in Coal in 1927, pages 415 to 421, and in a special study prepared for the World Power Conference.[16]

TABLE 68.—*Indicators of the effect of fuel economy on consumption of coal per unit of performance since the war*

	Pounds	Reduction (per cent)
Steam railroads:		
Pounds per 1,000 gross ton-miles freight service—		
Average, 1919–20	170	
Average, 1929	125	26.5
Pounds per passenger-train car-mile—		
Average, 1919–20	18.5	
Average, 1929	14.8	20.0
Electric public utility power plants:		
Pounds per kilowatt-hour, 1919	3.2	
Pounds per kilowatt-hour, 1929	1.68	47.5
Iron and steel—pounds coking coal per ton of pig: [a]		
1918	3,577	
1929	2,984	16.6
Coke manufacture: Savings of heat values through recovery of gas tar, light oils, and breeze by extension of by-product in place of beehive coking, 1913 to 1929, expressed as per cent of coal used for all coke in 1929 [b]		19.2

[a] Includes only savings through higher yields of merchantable coke per ton of coal charged and lower consumption of coke per ton of iron. Excludes economies through recovery of by-products, which are treated in next item.

[b] These by-products are used in part for boiler fuel, in part for metallurgical purposes, in part for domestic heating and cooking, and to a small extent for automotive fuel.

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[16] Tryon, F. G., and Rogers, H. O., Statistical Studies of Progress in Fuel Efficiency: Trans. Second World Power Conference, Berlin, 1930, vol. 6, pp. 343–365.

TABLE 69.—*Fuel efficiency of electric public-utility power plants in the United States, 1919–1929*

[From reports of division of power resources, United States Geological Survey]

Year	Kilowatt-hours generated (millions)			Per cent of total		Fuel consumed, coal and coal equivalent, net tons	Pounds of fuel consumed by fuel stations	
	By water	By fuel [1]	Total	By water	By fuel		Per kilowatt-hour	Per horsepower-hour
1919	14,606	24,315	38,921	37.5	62.5	38,880,000	3.2	2.4
1920	16,150	27,405	43,555	37.1	62.9	41,420,000	3.0	2.2
1921	14,970	26,005	40,975	36.5	63.5	35,240,000	2.7	2.0
1922	17,207	30,447	47,654	36.1	63.9	38,000,000	2.5	1.9
1923	19,343	36,322	55,665	34.8	65.2	43,522,000	2.4	1.8
1924	19,969	39,044	59,013	33.8	66.2	43,130,000	2.2	1.64
1925	22,356	43,514	65,870	33.9	66.1	44,780,000	2.1	1.57
1926	26,189	47,602	73,791	35.5	64.5	45,856,000	1.95	1.46
1927	29,875	50,330	80,205	37.2	62.8	45,910,000	1.84	1.37
1928	34,696	53,154	87,850	39.5	60.5	46,387,000	1.76	1.31
1929	34,629	62,723	97,352	35.6	64.4	52,574,000	1.68	1.25

[1] Includes power generated from wood, which in 1929 amounted to 439,000,000 kilowatt-hours. This is excluded in the calculation of total fuel consumed and average consumption per kilowatt-hour and horsepower-hour given in the last 3 columns.

TABLE 70.—*Fuel efficiency of locomotives in road service on Class I steam railroads, 1916–1929*

[From reports of the Interstate Commerce Commission, except as noted. The figures include the coal equivalent of other fuel]

Year	Pounds of coal per 1,000 gross ton-miles, including locomotive and tender	Pounds of coal per passenger-train car-mile	Year	Pounds of coal per 1,000 gross ton-miles, including locomotive and tender	Pounds of coal per passenger-train car-mile
1916	[1] 169	[1] 18.5	1923	161	18.1
1917	[1] 176	[1] 19.4	1924	149	17.0
1918	[1] 174	[1] 19.2	1925	140	16.1
1919	[1] 164	[1] 18.1	1926	137	15.8
1920	[2] 174	[2] 18.8	1927	131	15.4
1921	162	17.7	1928	127	15.0
1922	163	17.9	1929	125	14.8

[1] From reports of the fuel conservation section of the United States Railroad Administration, prepared under direction of Eugene McAuliffe. These reports gave the consumption per 1,000 gross ton-miles, excluding locomotive and tender, from which the ratio used above has been estimated.

[2] Estimated from the ratio per 1,000 gross ton-miles, excluding locomotive and tender, which bears a practically constant relation to the other.

TABLE 71.—*Fuel economy as indicated by the coal equivalent of the thermal by-products of coking in by-product ovens, 1913–1929*

[By-products included are coke breeze, which is not generally recovered in the manufacture of beehive coke, surplus gas not used in heating ovens, tar, and light oil]

Year	Equivalent coal (net tons)	Per cent which this forms of total coal made into coke	Increase in coal equivalent over 1913	Year	Equivalent coal (net tons)	Per cent which this forms of total coal made into coke	Increase in coal equivalent over 1913
1913	2,600,000	3.8		1922	9,058,000	16.7	+6,458,000
1914	2,461,000	4.8	−139,000	1923	12,417,000	14.7	+9,817,000
1915	3,280,000	5.3	+680,000	1924	11,628,000	17.9	+9,028,000
1916	4,375,000	5.4	+1,775,000	1925	13,786,000	18.5	+11,186,000
1917	5,432,000	6.5	+2,832,000	1926	15,394,000	18.6	+12,794,000
1918	6,785,000	8.0	+4,185,000	1927	15,642,000	21.0	+13,042,000
1919	7,575,000	11.5	+4,975,000	1928	17,426,000	22.6	+14,826,000
1920	9,316,000	12.2	+6,716,000	1929	19,262,000	22.2	+16,662,000
1921	6,461,000	17.4	+3,861,000				

TABLE 72.—*Fuel economy in manufacture of pig iron, 1912–1929*

Year	Pounds coke per gross ton pig iron and ferro-alloys [1]	Yield of coke from coal (per cent)	Pounds coal per gross ton of pig iron and ferro-alloys (column 1 divided by column 2)	Year	Pounds coke per gross ton pig iron and ferro-alloys [1]	Yield of coke from coal (per cent)	Pounds coal per gross ton of pig iron and ferro-alloys (column 1 divided by column 2)
1912	2, 436. 5	67. 1	3, 631. 1	1921	2, 200. 6	68. 0	3, 236. 2
1913	2, 433. 3	66. 9	3, 637. 2	1922	2, 176. 3	68. 3	3, 186. 4
1914	2, 354. 4	66. 9	3, 519. 3	1923	2, 243. 3	67. 5	3, 323. 4
1915	2, 252. 0	67. 2	3, 351. 2	1924	2, 212. 0	68. 1	3, 248. 2
1916	2, 285. 3	66. 8	3, 421. 1	1925	2, 150. 4	68. 8	3, 125. 6
1917	2, 339. 7	66. 4	3, 523. 6	1926	2, 091. 2	68. 6	3, 048. 4
1918	2, 375. 2	66. 4	3, 577. 1	1927	2, 122. 3	68. 6	3, 093. 7
1919	2, 310. 2	67. 4	3, 427. 6	1928	2, 088. 5	68. 4	3, 053. 4
1920	2, 305. 6	67. 4	3, 420. 8	1929	2, 058. 6	69. 0	2, 983. 5

[1] According to annual report, American Iron and Steel Institute. No data were published prior to 1912.

STOCKS OF COAL HELD BY CONSUMERS

Bituminous coal is seldom stored at the mines. The chief element in the reserves aboveground is the quantity held by consumers, which during the 12 years covered by the statistical record has ranged from 20,000,000 to 75,000,000 tons. The trend of stocks in 1929 and its influence upon the market have already been pointed out. A statistical summary of the stocks of consumers since October 1, 1916, the date of the earliest survey of stocks, is given in Table 73. (See also fig. 38, p. 676.) Details by localities appear in the quarterly mimeographed reports on stocks, which may be obtained upon application to the Bureau of Mines.

No record is available in tons of the total stocks of anthracite, but the last column of Table 73 shows the number of days' supply in the yards of a representative group of retail dealers.

TABLE 73.—*Stocks of bituminous coal in hands of commercial consumers and stocks of anthracite and bituminous coal in retail dealers' yards, 1916–1929*

[From periodic stock reports of the Bureau of Mines. Coal for steamship fuel, on lake docks, in transit, and in the bins of householders is not included]

Date	Total stock of bituminous coal estimated (tons) [1]	Day's supply at current rate of consumption on date of stock taking								
		By-product coke plants	Steel plants	Other industrials	Coal-gas plants	Electric utilities	Coal dealers, bituminous	Railroads	Total bituminous	Anthracite in retail yards
1916—Oct. 1	27, 000, 000	(2)	25		(2)	(2)	(2)	20	(3)	(2)
1917—Oct. 1	28, 100, 000	(2)	27		(2)	(2)	(2)	18	(4)	(2)
1918—July 15	39, 700, 000	28	27	48	72	39	15	25	31	(2)
Oct. 1	59, 000, 000	32	45	71	84	47	28	29	43	(2)
Armistice Day (Nov. 11)	63, 000, 000	35	45	71	85	49	37	31	45	(2)
1919—Jan. 1	57, 900, 000	32	42	65	81	49	39	32	42	36
Apr. 1	40, 400, 000	23	35	47	58	48	25	(2)	31	31
1920—Mar. 1	24, 000, 000	15	9	27	31	21	13	11	18	21
June 1	20, 000, 000	8	11	24	22	22	10	10	15	15
1921—Jan. 1	45, 800, 000	29	42	64	55	44	30	23	39	24
Apr. 1	39, 500, 000	28	38	47	66	48	26	24	36	36
Aug. 1	41, 000, 000	31	46	56	79	44	42	32	39	50
Nov. 1	48, 500, 000	38	46	67	87	54	46	31	43	47

[1] The figures for 1918 in this table are based upon an actual count. Beginning with Apr. 1, 1919, the figures are based upon reports from a selected list of 5,000 consumers whose stocks in 1918 bore a known relation to the known total stocks.

[2] No data.

[3] Data incomplete. Estimated as 22 days.

[4] Data incomplete. Estimated as 21 days.

TABLE 73.—*Stocks of bituminous coal in hands of commercial consumers and stocks of anthracite and bituminous coal in retail dealers' yards, 1916–1929*—Con.

Date	Total stock of bituminous coal estimated (tons)	Day's supply at current rate of consumption on date of stock taking								
		By-product coke plants	Steel plants	Other industrials	Coal-gas plants	Electric utilities	Coal dealers, bituminous	Railroads	Total bituminous	Anthracite in retail yards
1922—Jan. 1	48,000,000	42	48	51	89	51	33	35	41	44
Mar. 1	52,500,000	39	48	56	82	54	23	42	43	28
Apr. 1	[5] 63,000,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Sept. 1	22,000,000	11	12	32	34	26	11	13	17	5
Oct. 1	26,000,000	14	17	33	38	30	18	15	21	7
Nov. 1	32,000,000	18	21	39	55	32	21	13	23	11
1923—Jan. 1	36,000,000	19	27	40	60	33	18	16	26	11
Mar. 1	36,000,000	19	26	34	58	34	11	16	22	6
July 1	46,000,000	26	35	46	89	48	39	28	37	25
Aug. 1	52,000,000	27	35	54	104	52	45	39	44	25
Sept. 1	56,000,000	30	33	56	110	52	38	44	46	21
Oct. 1	60,000,000	33	39	56	91	49	36	41	45	22
1924—Jan. 1	62,000,000	35	43	55	91	51	34	44	46	37
June 1	51,000,000	34	56	53	88	63	40	50	49	49
Sept. 1	47,000,000	30	42	48	90	58	46	42	45	58
1925—Jan. 1	[5] 45,000,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Mar. 1	44,000,000	25	30	40	78	51	33	35	37	46
June 1	38,000,000	20	27	32	68	48	31	32	32	52
Sept. 1	43,000,000	22	30	30	67	43	27	28	32	53
Nov. 1	48,000,000	26	32	44	78	46	30	30	35	27
1926—Jan. 1	49,000,000	26	28	39	72	48	20	27	30	32
Feb. 1	45,000,000	23	26	37	67	47	17	25	28	18
Apr. 1	40,000,000	21	24	32	60	46	14	23	26	30
May 1	36,000,000	20	25	36	71	54	31	25	31	33
July 1	39,000,000	23	26	35	72	52	43	27	34	40
Aug. 1	41,000,000	24	32	35	61	45	31	30	33	44
Oct. 1	43,000,000	26	37	37	70	45	32	33	35	46
Dec. 31	55,000,000	34	50	41	69	47	23	33	37	54
1927—Apr. 1	75,000,000	38	73	62	77	70	24	59	53	39
July 1	63,400,000	40	59	64	87	76	48	54	54	50
Aug. 1	60,100,000	39	63	63	91	69	41	50	53	57
Oct. 1	61,900,000	40	58	62	93	69	43	48	53	60
Nov. 1	61,300,000	42	50	52	81	61	34	43	46	60
Dec. 31	55,500,000	38	45	44	79	58	27	41	41	57
1928—Feb. 1	51,500,000	29	36	41	81	62	22	38	36	42
Apr. 1	48,300,000	25	35	39	74	60	17	40	34	25
July 1	41,700,000	23	38	37	63	62	43	37	38	55
Oct. 1	41,100,000	27	31	37	72	56	33	29	35	57
Nov. 1	42,400,000	26	34	33	71	51	28	27	30	53
Dec. 31	41,800,000	27	34	33	72	53	26	26	31	54
1929—Apr. 1	36,000,000	19	25	26	57	50	17	23	25	34
July 1	33,100,000	21	26	27	55	50	42	20	28	59
Oct. 1	37,500,000	26	27	32	64	44	35	20	30	55
Nov. 1	39,800,000	28	30	31	64	44	25	20	28	48
Dec. 31	40,300,000	30	31	32	67	45	23	21	28	44

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[2] No data.

[5] No canvass of consumers was made on this date. The total was estimated from stocks reported in the preceding canvass.

DISTRIBUTION

Tables of the movement of coal to the Great Lakes, to tidewater, and to New England and of certain other major currents of distribution have been included in earlier reports of this series (see Coal in 1928, pp. 512–527) but are this year reserved for a special analysis of distribution in 1929. A copy of the distribution report may be had upon application to the Bureau of Mines. Tables 74 and 75 record two features of the distribution of bituminous coal that bear closely on the statistics of production.

MINE FUEL, LOCAL SALES, COAL COKED AT MINES, AND SHIPMENTS

The primary distribution classification is that used throughout the basic tables of this report: "Used at mines for power and heat," "Sold to local trade and used by employees," "Made into coke at mines," and "Loaded at mines for shipment." The proportion disposed of under these several classifications varies greatly from district to district, and it also tends to change with the years. (See Table 74.) The proportion used as fuel by the mines has been declining because of the growing practice of buying power to operate the collieries from central electric stations. The proportion made into coke at the mines has also been declining because of the steady replacement of beehive with by-product coke. The proportion sold locally, without shipment, on the other hand, has been increasing in recent years. In 1929, the local sales amounted to 23,262,558 tons, or 4.3 per cent of the total. This quantity includes coal furnished to colliery employees, often at nominal prices; coal delivered direct to tenders of steam locomotives at the tipple (a very considerable item in some districts); sales by truck and wagon in near-by towns; and sales to electric power stations or industries, such as brick and tile works, adjacent to the mines.

The net result of the several shifts in disposal has been to increase the proportion of the total output loaded at the mines for shipment. From 78.5 per cent of the total in 1890, the shipments have risen to 93.1 per cent in 1929. Corresponding data for anthracite will be found in Table 18A (p. 849).

TABLE 74.—*Shift in disposal of total output of bituminous coal, 1890–1929*

Year	Per cent of total—				Year	Per cent of total—			
	Loaded at mines for shipment	Made into coke at mines	Sold to local trade and used by employees	Used at mines for power and heat		Loaded at mines for shipment	Made into coke at mines	Sold to local trade and used by employees	Used at mines for power and heat
1890	78.5	13.8	6.3	1.4	1920	88.8	5.4	3.7	2.1
1895	78.7	13.6	6.2	1.5	1921	91.8	2.1	3.9	2.2
1900	81.5	13.0	3.7	1.8	1922	90.9	3.1	4.1	1.9
1905	80.9	13.5	3.4	2.2	1923	89.6	4.9	3.9	1.6
1910	82.2	12.5	3.0	2.3	1924	91.3	3.0	4.3	1.4
1915	85.8	9.2	2.8	2.2	1925	91.8	3.0	4.1	1.1
1916	84.3	10.4	3.2	2.1	1926	91.8	3.1	4.1	1.0
1917	85.2	9.1	3.5	2.2	1927	92.7	2.1	4.2	1.0
1918	86.8	7.8	3.2	2.2	1928	93.3	1.4	4.4	.9
1919	87.8	5.9	3.9	2.4	1929	93.1	1.7	4.3	.9

BITUMINOUS COAL LOADED FOR SHIPMENT BY INDIVIDUAL RAILROADS AND WATERWAYS, AS REPORTED BY OPERATORS

The sum of the coal charged into coke ovens at the mines, the local sales, and the mine fuel in 1929 was 37,054,139 tons out of a total production of 534,988,593 tons. The remainder, 497,934,454 tons, was loaded at the mines for shipment, and of this 23,066,289 tons was loaded into barges and other river vessels and 474,868,165 tons was loaded into railroad cars. Table 75 shows the quantity so originated on each railroad and waterway, as reported by mine operators in answer to the following question:

Railroads or waterways on which product was first loaded for shipment:
Name of road or waterway--
(Give shipments over each road separately) Tons

As these statistics include nonrevenue railroad fuel they may differ from those compiled by the railroad companies, which often show only revenue freight and include coal received from connecting lines or coal shipped off the lake docks, as well as that originating at mines on the lines reporting.

Where the road serving the district is a subsidiary of a larger road some operators may report their coal as loaded on the subsidiary and others as loaded on the parent system. In general, the figures shown here appear under the name reported by the operator, and the bureau does not attempt to combine them by systems, believing that such combinations can best be made by those using the figures, who are usually familiar with coal-traffic problems. To approximate the total for the Southern system, for example, the reader should add to the total shown for the Southern Railway the figures for the Alabama Great Southern; Northern Alabama; Cincinnati, New Orleans & Texas Pacific; and Harriman & Northeastern lines. If such a combination is made, the total will usually be found to check reasonably with the statistics issued by such railroads as keep records of total coal originated.

The figures for the Chicago & Eastern Illinois Railroad include coal loaded in cars of the Elgin, Joliet & Eastern and moved by the latter road over the rails of the Chicago & Eastern Illinois under a trackage agreement.

The Kanawha & Michigan, Toledo & Ohio Central, and Zanesville & Western are shown separately when so reported, rather than in combination with the New York Central, although it is apparent that many operators served by these subsidiaries have reported the name of the parent road.

The quantities shown in the following table, as shipped by waterways, do not all agree with statistics on river traffic published by the United States Engineer Office. In partial explanation, it should be remembered that shipments of coal loaded in cars at the mines and later transferred to boats would be classified by the Bureau of Mines as "rail" and by the Engineer Office as "river." Thus, coal originating at mines in Logan County, W. Va., and transshipped at Huntington by river vessel to Cincinnati, Ohio, would be credited by the Bureau of Mines to the Chesapeake & Ohio Railroad, although properly appearing in the engineer office figures of total traffic on the Ohio River.

TABLE 75.—*Bituminous coal loaded for shipment by individual railroads and waterways, as reported by operators, in 1929, in net tons*

Route	State	Quantity	
		By State	Total for route
RAILROADS			
Alabama Central	Alabama	95,986	95,986
Alabama Great Southern	do	100,934	100,934
Alaska	Alaska	94,600	94,600
Artemus Jellico	Kentucky	134,892	134,892
Atchison, Topeka & Santa Fe	Colorado	567,755	3,944,324
	Illinois	554,617	
	Kansas	553,478	
	Missouri	444,519	
	New Mexico	1,770,346	
	Oklahoma	53,609	
Baltimore & Ohio	Illinois	613,516	37,051,756
	Indiana	392,525	
	Maryland	43,011	
	Ohio	4,924,429	
	Pennsylvania	9,810,664	
	West Virginia	21,267,611	

TABLE 75.—*Bituminous coal loaded for shipment by individual railroads and waterways, as reported by operators, in 1929, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Bessemer & Lake Erie	Pennsylvania	3,318,744	3,318,744
Bevier & Southern	Missouri	116,631	116,631
Big Sandy & Cumberland	Kentucky	5,384	5,384
Big Sandy & Kentucky River	do	60,961	60,961
Buffalo & Susquehanna	Pennsylvania	1,114,232	1,114,232
Buffalo Creek & Gauley	West Virginia	677,468	677,468
Buffalo, Rochester & Pittsburgh	Pennsylvania	6,504,344	6,504,344
Cambria & Indiana	do	3,403,587	3,403,587
Campbell's Creek	West Virginia	848,269	848,269
Carbon County	Utah	489,334	489,334
Caseyville	Illinois	105,848	105,848
Central of Georgia	Alabama	993,279	1,037,200
	Georgia	43,921	
Chaffee	Maryland	132,138	132,138
Chesapeake & Ohio	Kentucky	10,420,006	56,017,277
	West Virginia	45,597,271	
Cheswick & Harmar	Pennsylvania	725,310	725,310
Chicago & Alton	Illinois	2,141,800	2,206,753
	Missouri	64,953	
Chicago & Eastern Illinois	Illinois	3,079,521	5,992,374
	Indiana	2,912,853	
Chicago & Illinois Midland	Illinois	3,231,552	3,231,552
Chicago & North Western	do	3,307,032	3,587,514
	Iowa	202,039	
	Wyoming	78,443	
Chicago, Burlington & Quincy	Colorado	468,335	13,749,378
	Illinois	11,535,055	
	Iowa	308,326	
	Missouri	192,863	
	Wyoming	1,244,799	
Chicago Great Western	Iowa	142,077	142,077
Chicago, Indianapolis & Louisville	Indiana	1,428,825	1,428,825
Chicago, Milwaukee, St. Paul & Pacific	Illinois	3,350	7,328,494
	Indiana	5,279,216	
	Iowa	798,553	
	Missouri	64,823	
	Montana	1,073,111	
	North Dakota	57,166	
	South Dakota	200	
	Washington	52,075	
Chicago, Rock Island & Pacific	Colorado	2,620	2,405,625
	Illinois	67,510	
	Iowa	1,132,008	
	Missouri	33,090	
	Oklahoma	1,124,913	
	Texas	45,484	
Chicago, Springfield & St. Louis	Illinois	779,682	779,682
Cincinnati, New Orleans & Texas Pacific	Kentucky	38,431	78,006
	Tennessee	39,575	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	5,297,220	5,761,861
	Indiana	464,641	
Clinchfield	Kentucky	56,000	2,014,708
	Virginia	1,958,708	
Colorado & Southeastern	Colorado	364,432	364,432
Colorado & Southern	do	1,717,915	1,717,915
Colorado & Wyoming	do	431,653	431,653
Conemaugh & Black Lick	Pennsylvania	39,298	39,298
Crystal River & San Juan	Colorado	18,864	18,864
Cumberland & Pennsylvania	Maryland	1,250,381	1,250,381
Dardanelle & Russellville	Arkansas	103,538	103,538
Dents Run	Pennsylvania	64,400	64,400
Denver & Intermountain	Colorado	86,150	86,150
Denver & Rio Grande Western	do	2,314,013	4,865,408
	New Mexico	24,728	
	Utah	2,526,667	
Denver & Salt Lake	Colorado	955,657	955,657
Des Moines & Central Iowa	Iowa	235,786	235,786
Detroit, Toledo & Ironton	Ohio	7,598	7,598
East Broad Top Railroad & Coal Co	Pennsylvania	463,267	463,267
Eastern Kentucky	Kentucky	103	103
Eastern Railway & Lumber Co	Washington	8,091	8,091
East St. Louis & Suburban	Illinois	54,857	54,857
Erie	Ohio	19,297	817,071
	Pennsylvania	797,774	
Evansville & Ohio Valley	Indiana	81,242	81,242
Evansville, Indianapolis & Terre Haute	do	2,428,939	2,428,939
Evansville, Suburban & Newburgh	do	87,482	87,482

TABLE 75.—*Bituminous coal loaded for shipment by individual railroads and waterways, as reported by operators, in 1929, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Fort Smith & Western	Oklahoma	160, 664	160, 664
Fort Smith, Subiaco & Rock Island	Arkansas	500	500
Great Northern	Montana	240, 634	774, 387
	North Dakota	326, 521	
	Washington	207, 232	
Harriman & Northeastern	Tennessee	202, 797	202, 797
Hocking Valley	Ohio	1, 703, 988	1, 703, 988
Huntingdon & Broad Top Mountain Railroad and Coal Co.	Pennsylvania	521, 478	521, 478
Illinois Central	Alabama	302, 536	19, 678, 518
	Illinois	9, 994, 781	
	Indiana	240, 787	
	Kentucky	9, 140, 414	
Illinois Terminal	Illinois	655, 528	655, 528
Indian Creek Valley	Pennsylvania	322, 341	322, 341
International & Great Northern	Texas	89, 094	89, 094
Interstate	Kentucky	243, 088	2, 932, 026
	Virginia	2, 688, 938	
Iowa Southern Utilities Co	Iowa	175, 169	175, 169
Jefferson Southwestern	Illinois	221	221
Johnstown & Stony Creek	Pennsylvania	31, 459	31, 459
Joplin & Pittsburg	Kansas	269, 761	269, 761
Kanawha & Michigan (see also New York Central)	West Virginia	103, 845	103, 845
Kanawha Central	do	209, 015	209, 015
Kanawha, Glen Jean & Eastern	do	1, 291, 728	1, 291, 728
Kansas City, Clay County & St. Joseph	Missouri	27, 735	27, 735
Kansas City Southern	Arkansas	9, 695	628, 211
	Kansas	178, 956	
	Missouri	367, 965	
	Oklahoma	71, 595	
Kansas, Oklahoma & Gulf	do	178, 513	178, 513
Kelley's Creek & Northwestern	West Virginia	1, 278, 536	1, 278, 536
Kentucky & Tennessee	Kentucky	963, 907	963, 907
Kentucky, Rock Castle & Cumberland	do	5, 500	5, 500
Lake Erie, Franklin & Clarion	Pennsylvania	231, 925	231, 925
Laramie, North Park & Western	Colorado	48, 601	48, 601
Ligonier Valley	Pennsylvania	344, 369	344, 369
Litchfield & Madison	Illinois	663, 721	663, 721
Louisville & Nashville	Alabama	3, 857, 287	36, 869, 712
	Illinois	230, 401	
	Kentucky	31, 623, 367	
	Tennessee	811, 511	
	Virginia	347, 146	
Marion & Eastern	Illinois	581, 201	581, 201
Mary Lee	Alabama	693, 050	693, 050
Michigan Central	Michigan	491, 324	491, 324
Midland Valley	Arkansas	245, 495	745, 132
	Oklahoma	499, 637	
Minneapolis & St. Louis	Illinois	413, 246	603, 998
	Iowa	190, 752	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	474, 635	474, 635
Missouri-Illinois	Illinois	306, 506	306, 506
Missouri-Kansas-Texas	Kansas	28, 459	785, 098
	Missouri	62, 690	
	Oklahoma	579, 100	
	Texas	114, 849	
Missouri Pacific	Arkansas	1, 085, 089	8, 451, 595
	Illinois	5, 283, 191	
	Kansas	946, 023	
	Missouri	1, 137, 292	
Mobile & Ohio	Alabama	594, 832	842, 404
	Illinois	247, 572	
Monongahela	Pennsylvania	7, 892, 035	15, 989, 764
	West Virginia	8, 097, 729	
Montana	Arkansas	71, 140	71, 140
Montana, Wyoming & Southern	Montana	464, 276	464, 276
Montour	Pennsylvania	6, 190, 717	6, 190, 717
Nashville, Chattanooga & St. Louis	Tennessee	1, 028, 569	1, 028, 569
New Mexico Midland	New Mexico	23, 005	23, 005
New York Central (includes some coal shipped over subsidiary roads: Kanawha & Michigan, Toledo & Ohio Central, and Zanesville & Western)	Ohio	3, 431, 249	10, 139, 293
	Pennsylvania	4, 725, 864	
	West Virginia	1, 982, 180	
New York, Chicago & St. Louis	Illinois	526, 879	533, 564
	Indiana	6, 685	
Norfolk & Western	Kentucky	5, 639, 428	44, 845, 046
	Virginia	3, 926, 273	
	West Virginia	35, 279, 345	
Norfolk Southern	North Carolina	46, 280	46, 280
Northern Alabama	Alabama	713, 618	713, 618

TABLE 75.—*Bituminous coal loaded for shipment by individual railroads and waterways, as reported by operators, in 1929, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Northern Pacific	Montana	1,443,884	3,457,976
	North Dakota	584,666	
	Washington	1,429,426	
Norton & Northern	Virginia	38,451	38,451
Ohio & Kentucky	Kentucky	61,095	61,095
Ohio River Electric	Ohio	2,639	2,639
Oklahoma City-Ada-Atoka	Oklahoma	120,347	120,347
Oneida & Western	Tennessee	3,325	3,325
Oregon Short Line	Idaho	4,200	878,868
	Wyoming	874,668	
Oregon-Washington Railroad & Navigation Co	Washington	237,897	237,897
Pacific Coast	do	364,898	364,898
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago & St. Louis)	Illinois	724,391	55,136,319
	Indiana	2,254,452	
	Ohio	5,615,531	
	Pennsylvania	44,681,516	
	West Virginia	1,860,429	
Peoria & Eastern	Illinois	126,105	126,105
Peoria & Pekin Union	do	335,748	335,748
Peoria, Hanna City & Western	do	1,115,467	1,115,467
Pere Marquette	Michigan	253,193	253,193
Peru, La Salle & Deer Park	Illinois	61,128	61,128
Pittsburg & Shawmut	Pennsylvania	2,033,954	2,033,954
Pittsburg County	Oklahoma	9,864	9,864
Pittsburg, Shawmut & Northern	Pennsylvania	737,214	737,214
Pittsburgh & Lake Erie	do	5,388,705	5,388,705
Pittsburgh & Susquehanna	do	76,949	76,949
Pittsburgh & West Virginia (includes West Side Belt)	Ohio	276,278	3,424,504
	Pennsylvania	2,979,703	
	West Virginia	168,523	
Pittsburgh, Chartiers & Youghiogheny	Pennsylvania	439,961	439,961
Pittsburgh, Lisbon & Western	do	32,867	32,867
Preston	West Virginia	249,015	249,015
Quincy, Omaha & Kansas City	Missouri	8,091	8,091
Rio Grande & Eagle Pass	Texas	23,343	23,343
Rio Grande Eastern	New Mexico	10,117	10,117
Rio Grande Southern	Colorado	20,246	20,246
Rockdale, Sandow & Southern	Texas	301,996	301,996
St. Louis & Belleville Electric	Illinois	44,516	44,516
St. Louis & Hannibal	Missouri	14,833	14,833
St. Louis & O'Fallon	Illinois	267,707	267,707
St. Louis & Ohio River	do	297,938	297,938
St. Louis-San Francisco	Alabama	2,595,663	5,048,663
	Arkansas	144,116	
	Kansas	641,923	
	Missouri	863,292	
	Oklahoma	803,669	
St. Louis Southwestern of Texas	Texas	385,673	385,673
St. Louis, Troy & Eastern	Illinois	333,844	333,844
San Antonio Southern	Texas	21,152	21,152
Scott's Run	West Virginia	763,753	763,753
Southern	Alabama	2,722,634	10,236,875
	Illinois	446,532	
	Indiana	1,809,952	
	Kentucky	389,656	
	Tennessee	1,811,639	
	Virginia	3,056,462	
Southern Illinois Railway & Power Co	Illinois	43,461	43,461
Southern Pacific	New Mexico	686,775	695,058
	Oregon	3,640	
	Texas	4,643	
Susquehanna & New York	Pennsylvania	12,036	12,036
Tennessee	Tennessee	499,865	499,865
Tennessee Central	do	704,118	704,118
Tennessee Coal, Iron & Railroad Co	Alabama	2,962,581	2,962,581
Texas & New Orleans	Texas	24,433	24,433
Texas & Pacific	do	35,037	35,037
Texas Short Line	do	29,661	29,661
Thomas & Sayreton	Alabama	590,132	590,132
Toledo & Ohio Central (see also New York Central)	Ohio	553,445	553,445
Toledo, Peoria & Western	Illinois	50,618	50,618
Toronto, Knoxville & Western	Ohio	134,213	134,213
Uintah	Colorado	10,764	10,764
Union	Pennsylvania	14,986	14,986
Union Pacific	Colorado	1,657,812	5,908,694
	Kansas	17,000	
	Utah	46,177	
	Wyoming	4,187,705	

TABLE 75.—*Bituminous coal loaded for shipment by individual railroads and waterways, as reported by operators, in 1929, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Unity	Pennsylvania	844,340	844,340
Utah	Utah	2,010,349	2,010,349
Virginian	Virginia	103,734	11,053,897
	West Virginia	10,950,163	
Wabash	Illinois	2,190,110	2,458,090
	Iowa	199,091	
	Missouri	68,889	
Washington Run	Pennsylvania	654,086	654,086
Western Allegheny	do	244,929	244,929
Western Maryland	Maryland	1,092,562	4,411,523
	Pennsylvania	330,824	
	West Virginia	2,988,137	
West Side Belt	Pennsylvania	(1)	(1)
West Virginia Northern	West Virginia	180,071	180,071
Wheeling & Lake Erie	Ohio	3,701,497	3,701,497
Winfield	Pennsylvania	27,470	27,470
Winifrede	West Virginia	3,530	3,530
Woodward Iron Co	Alabama	1,145,995	1,145,995
Youngstown & Ohio River	Ohio	39,617	39,617
Zanesville & Western (see also New York Central)	do	306,769	306,769
Total railroad shipments		474,868,165	474,868,165
WATERWAYS			
Allegheny River	Pennsylvania	937,986	937,986
Black Warrior River	Alabama	90,922	90,922
Green River	Kentucky	78,122	78,122
Kanawha River	West Virginia	293,893	293,893
Monongahela River	Pennsylvania	21,124,594	21,124,594
Muskingum River	Ohio	120,000	120,000
Ohio River	Kentucky	263,995	420,020
	Ohio	4,301	
	Pennsylvania	604	
	West Virginia	151,120	
Tradewater River	Kentucky	752	752
Total waterway shipments		23,066,289	23,066,289
Grand total, loaded at mines for shipment by railroads and waterways		497,934,454	497,934,454
Sold to local trade and used by employees		23,262,558	23,262,558
Used at mines for power and heat		4,662,974	4,662,974
Made into coke at mines		9,128,607	9,128,607
Total production		534,988,593	534,988,593

[1] Included under Pittsburgh & West Virginia.

IMPORTS AND EXPORTS [17]

IMPORTS

The exigencies of supply and trade make the United States both an importer and exporter of coal. Although this country has a large exportable surplus certain districts in the Northwest depend upon supplies from Canada. Many other principal coal-producing countries import as well as export coal. This condition in the movement of coal across international boundary lines is inherent in the trade of any commodity of low value per unit of weight, and the distribution of such a commodity in world trade is governed more by the cost of transportation than by tariff regulations.

Under normal conditions of trade and production imports into the United States fluctuate little from month to month or year to year.

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[17] Tables of imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from the records of the Bureau of Foreign and Domestic Commerce.

They consist almost entirely of bituminous coal from Vancouver Island and the Crow's Nest Pass field of British Columbia received in Washington, Montana, and Idaho; of much smaller amounts from Nova Scotia received in northern New England; and of small quantities of coal brought as ballast in vessels from the United Kingdom, Australia, and Japan.

Only in periods of acute shortage in America and relative abundance in Europe does bituminous coal cross the Atlantic in volume to our shores. This extraordinary condition occurred during the anthracite strike of 1902 and again 20 years later during the great strike of 1922, when the organized miners in both the anthracite and the bituminous fields were on strike for five months. In the latter year 3,294,000 tons of bituminous coal was received from Europe; practically all of it came from the British Isles, and the total imports from all sources reached 5,060,000 tons.

During the last three years, however, imports of bituminous coal have averaged only about one-half million tons. (See Table 76.) In 1929 the total imports were 495,000 tons, of which 456,000 tons, or 92 per cent, came from Canada. Of the imports from Canada, 298,473 tons was received in Idaho and Montana, largely for use as locomotive fuel on American railways.

Until recently imports of anthracite were insignificant. The miners' strikes of 1922 and 1925–26, however, enabled European anthracite to gain a foothold in some of the coastal cities, and since then importation has continued on a small but apparently increasing scale. The total imports of anthracite from all countries follow:

	Net tons		Net tons
1913	2, 000	1923	300, 000
1917	13, 000	1924	118, 000
1918	37, 000	1925	383, 000
1919	83, 000	1926	814, 000
1920	32, 000	1927	119, 000
1921	9, 000	1928	385, 000
1922	234, 000	1929	487, 000

The maximum imports occurred in the strike year 1926 and amounted to 814,000 tons (see Table 77), of which 522,000 tons came from the United Kingdom, 198,000 from Germany, and 54,000 from the Netherlands. Since then Germany and the Netherlands have virtually dropped out of the list of shippers. In 1928, for example, of the total of 385,000 tons imported, 353,000 came from the United Kingdom (Wales and Scotland). In 1929 imports from the United Kingdom continued at about the same figure; and a new competitor, Soviet Russia, entered the market, supplying in that year about 127,000 tons.

The anthracite imported is consumed almost exclusively in the coast cities of New England, chiefly in Boston and Providence. (See Table 77.) A little was received in Baltimore, Philadelphia, and New York during 1925–26, but practically none in 1929.

Table 76.—*Bituminous coal imported, by countries and districts, 1925–1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country and district	1925	1926	1927	1928	1929
COUNTRY OF ORIGIN					
North America:					
Canada	527,759	407,464	497,717	462,827	455,738
Mexico	150	250	212	320	5,719
Newfoundland and Labrador		5			
Salvador		1,120			
West Indies—					
British—					
Jamaica			112		
Other			168		
Cuba		37			
South America:					
Brazil				67	116
Chile	2				
Peru			1		
Venezuela		1			
Europe:					
Belgium		140	280	118	
France	67	2			
Germany	450	632		5,716	2
Italy	6		168		
Netherlands	2,473	280	325	280	
Poland and Danzig				3,462	
Soviet Russia				1	
United Kingdom	40,228	38,330	30,407	53,418	20,617
Asia:					
China		10		1	
Japan	17,190	32,454	15,920	17,115	8,147
Kwantung, leased territory	25				
Philippine Islands	4				
Africa:					
Algeria and Tunisia				791	
Canary Islands			56		
Oceania:					
Australia	10,919	4,941	4,477	2,410	4,880
New Zealand	2,464				
	601,737	485,666	549,843	546,526	495,219
DISTRICT OF ENTRY					
Alaska	47,230	30,581	30,481	32,518	27,072
Arizona		26			
Buffalo			113		330
Chicago		356			3
Connecticut	48				
Dakota	11,524	10,483	9,741	11,212	11,238
Duluth-Superior	678	473	980	454	533
Florida	90	37			
Galveston		1,260	885	896	
Hawaii	25,043	37,104	20,256	24,747	25,385
Los Angeles	29	632			113
Maine and New Hampshire	19,304	50,533	49,344	56,477	40,710
Maryland		280		3,462	1,120
Massachusetts	10,544	1,840	34	20,380	5,229
Michigan	6	437	47	440	
Minnesota					18
Montana-Idaho	343,813	253,894	330,788	307,629	298,473
New Orleans			336		157
New York	10,518	230	4,502	4,948	3,986
Oregon	3,295	10	235	403	790
Philadelphia	2,271	675		6	
Pittsburgh				1	
Porto Rico			280		
Rhode Island	5,962	7,155			
St. Lawrence	101	3,017	4,195	405	
San Antonio	150	224	213	320	5,719
San Francisco	8,124	1,570		5,784	63
South Carolina			280	112	
Vermont	3	119	348	31	
Washington	113,004	84,730	96,785	76,301	74,280
	601,737	485,666	549,843	546,526	495,219

TABLE 77.—*Anthracite imported, by countries and districts, 1925-1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country and district	1925	1926	1927	1928	1929
COUNTRY OF ORIGIN					
Australia	4,480			325	
Belgium	5,684	27,910			
Brazil		2			
British West Indies (other)	12				
Canada	6,834	9,696	3,391	4,620	3,745
China	112				
Cuba	1				
France		2,779			11
Germany	36,636	198,011	2	13,223	3,089
Japan	3,946	(1)	2,778	7,838	
Netherlands	6,485	53,730	3,030	5,471	
Peru				3	
Soviet Russia in Europe					126,751
United Kingdom	318,592	521,827	109,829	353,227	353,576
Venezuela		1			
Virgin Islands of the United States	112				
	382,894	813,956	119,030	384,707	487,172
DISTRICT OF ENTRY					
Alaska		3	11		
Buffalo	722	746	1,418	1,177	1,276
Connecticut		11,985			
Dakota	724	56			
Duluth-Superior	64	300	141		
Florida	1				
Galveston			117		
Hawaii	3,492		2,778	7,838	
Los Angeles				30	
Maine and New Hampshire	47,543	135,408	24,014	17,542	46,493
Maryland		3,743		2,740	
Massachusetts	117,057	210,918	63,137	307,796	321,413
Michigan	58		170		57
Montana-Idaho	300				
New York	145,168	393,930	4,490	1,516	16
Ohio		1			
Philadelphia	2,789	27,375			
Porto Rico	124				
Rhode Island	58,531	29,056	18,865	43,699	115,463
St. Lawrence	383	178	112	337	6
San Francisco	4,934	9	2	526	2,406
Vermont	892	92	143		42
Washington	112	156	3,632	1,506	
	382,894	813,956	119,030	384,707	487,172

[1] Less than 1 ton.

EXPORTS

In the work of the United States Department of Commerce responsibility for the promotion of foreign trade in coal is vested in the Bureau of Foreign and Domestic Commerce, which maintains a special coal section for the purpose. Information on the demand for coal in foreign countries and on the export market will be found in the current reports and bulletins issued by that bureau.

The field of the coal division of the Bureau of Mines is primarily the internal coal trade of the country. In this report, therefore, the discussion of exports is limited to presenting as much of a statistical background as is necessary for understanding the domestic market. In normal times the export trade absorbs only 3 or 4 per cent of the national output; but in certain fields it is an important element in the demand, and at times—as for example in 1926—extraordinary developments in the export trade have furnished the clue to unexpected behavior of the internal markets of the country.

In considering exports of bituminous coal, it is well to distinguish between the movement to Canada; the sea-borne exports to near-by destinations, especially in the Caribbean; and the shipments to what may be called "overseas" destinations, lying at greater distances from our shores. The statistical grouping of destinations that will best fit the problems of the American export trade is being discussed by the Coal Exporters' Association of the United States as this report goes to press. Pending receipt of the final recommendations of the exporters' association, the following tentative grouping is used for the purpose of the present discussion:

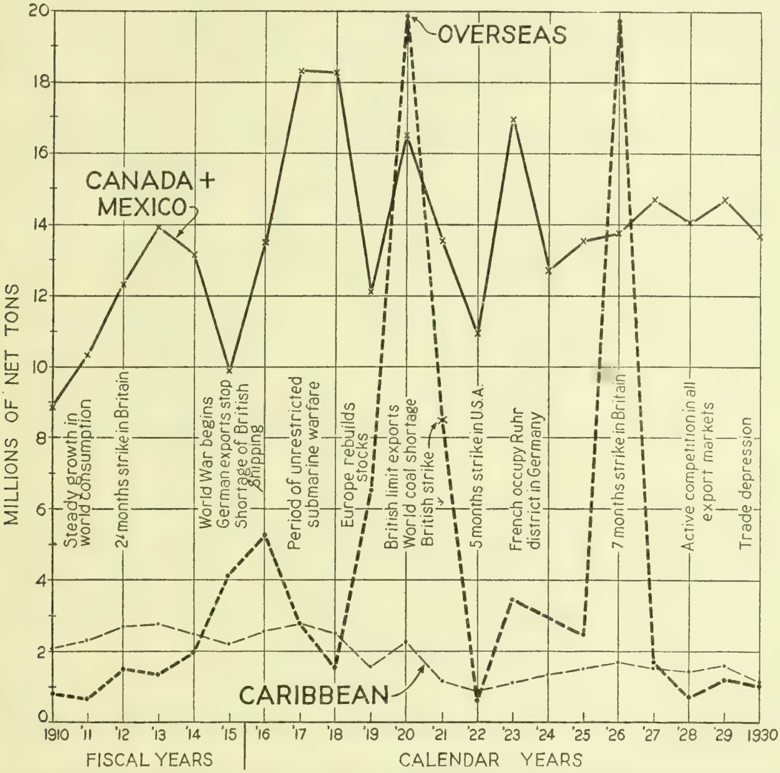

FIGURE 54.—Twenty years exports of bituminous coal to (1) Canada and Mexico, (2) the Caribbean, and (3) "overseas" destinations. Exports to Canada (including also the small shipments to Mexico) have been relatively stable except for the changes in general business conditions and run closely parallel to the domestic demand within the United States. Exports to the Caribbean region and other destinations adjacent to North America are also comparatively stable, because American shippers have a decided advantage in these markets. Exports "overseas" have been small except when competition of British or German coal was shut off. In 1920 and 1926 overseas exports increased so as to be a dominant influence on prices in the internal markets of the country

(1) Canada and Mexico.
(2) Caribbean region; that is the West Indies, and Central America, including the Bahamas, the Virgin Islands, and Panama.
(3) "Overseas" destinations, including Bermuda, Newfoundland, Miquelon-St. Pierre, and all countries in South America, Europe, Africa, Asia, and Oceania.

Figure 54 and Table 78 show the exports, subdivided in this way, over the last 20 years, a period long enough to indicate the trend.

TRADE WITH CANADA

By far the largest element in our export trade is the movement to Canada, which in normal times makes up 80 per cent or more of the total exports. In contrast with the fluctuating shipments overseas, the Canadian movement is stable and of long standing.

A part of the exports to Canada move by vessel from Hampton Roads or other North Atlantic ports to the Gulf of St. Lawrence, shipments by this route in 1929 being 162,720 tons. The great bulk of the Canadian exports, however, move either all rail or by vessel on the Great Lakes. Considerable tonnages are also dispatched by railroad-car ferry across Lakes Erie and Ontario. With the shipments to Canada may be grouped for statistical convenience the small tonnage moving to Mexico, which goes chiefly all rail. In Table 78, therefore, the exports to Canada and Mexico are separated from those to other countries which, of course, are carried by sea.

Although Canada is richly endowed with low-rank bituminous coal and lignite—the reserves being estimated at approximately 16 per cent of the world's supply—her fields of high-rank coals are confined to the Maritime Provinces of Nova Scotia and New Brunswick on the east and British Columbia on the west. In the prairie provinces are enormous reserves of low-rank bituminous coal and lignite, but a great stretch of central Canada is without coal of any grade. This area—the most densely populated and highly industrialized part of the Dominion—has for many years depended chiefly upon the mines of the United States, normally purchasing 3,000,000 to 4,000,000 net tons of anthracite and 12,000,000 to 17,000,000 tons of bituminous coal. Probably no part of the coal trade of the United States proceeds more steadily than the export movement to Canada. The coal moves year after year to the same destinations, over the same transportation routes, and often through the same wholesale channels. Large Canadian consumers have even acquired mines in the United States. The fluctuations in the quantity shipped to Canada from one year to the next are no greater than those in the domestic consumption of the United States, for business conditions in the two countries are as a rule much alike.

The absence of coal deposits in the central provinces and the long-standing character of the export movement from the United States place a heavy obligation upon the coal trade of this country to continue the movement. Canadian consumers have shared with those in the United States the inconveniences resulting from strikes and car shortages on this side of the boundary, and it is not surprising that the frequent occurrence of these disturbances in the past has awakened among Canadians a desire to be less dependent upon outside sources for their fuel supply. For the present and for many years to come, however, the needs of Canada must be treated as no less pressing than those of the several States in framing any emergency program for the distribution of coal. The budget of the United States Fuel Administration during the war provided shipments to Canada in the same ratio to estimated requirements as that allotted to the individual States, and the Canadian Government cooperated by imposing the same regulations upon consumers in Canada that were in force in the United States. Again, in the distribution of fuel after the strikes of 1922 and 1925–26, the program adopted for anthracite placed Canada on the same basis as the several States.

The trend of the Canadian movement, including the very small tonnage dispatched to Mexico, is shown by the heavy black line in Figure 54. The record represents fiscal years up to 1915 and calendar years thereafter. The curve closely parallels the domestic production of the United States. It shows a period of rapid growth up to the outbreak of the World War. Then appears the depression of the fiscal year 1915 (July 1, 1914, to June 30, 1915), which covers the first months of the war when Canadian industry was unsettled and the manufacture of munitions was hardly under way. Then follows the peak of the later war period when munitions manufacture was in full blast and bituminous coal was in demand to supplement the restricted supply of anthracite. After the war peak comes the reaction of 1919, reflecting in part a liquidation of the heavy reserves accumulated by consumers during 1918. Then follows the boom of 1920, the business depression of 1921, the great strike of 1922 which affected Canadian as well as American mines, and the active year 1923 when consumers were buying heavily to rebuild the stocks exhausted in the previous year. Perhaps the outstanding feature of the postwar years is the checking of the former growth of demand. The Canadian market, like that of the United States, has felt the pressure of fuel economy and the competition of other sources of energy, especially of water power; and whereas up to 1918 our exports to Canada were growing rapidly since then they have shown no consistent gain.

In 1929 the shipments to Canada and Mexico were 14,727,000 tons, an increase of 4.8 per cent over 1928 and almost exactly the same as in 1927.

Exports of anthracite to Canada in 1929 were 3,376,000 net tons (see Table 81) and to all other countries combined, only 30,000 tons. A few shiploads of anthracite moved to Newfoundland and Cuba and insignificant tonnages to a dozen other countries. Canada remains the great external outlet of the Pennsylvania anthracite industry.

EXPORTS TO THE CARIBBEAN

In previous reports of this series, exports to all countries other than Canada and Mexico have been referred to under the general term "sea borne." Although the term is technically correct it is better to consider the exports to the Caribbean region separately from those moving greater distances overseas. In the Caribbean, American exporters have an advantage in distance over the British and German companies, who are their major competitors in the world's ocean-borne trade. As here used the term covers the West Indies, including the Bahamas, and Central America, including Panama. Shipments to South American ports on the south shore of the Caribbean Sea are insignificant in amount and for statistical purposes are grouped in Table 78, with the rest of South America, under "Overseas."

The record of shipments to the Caribbean group is represented by the light dashed line in Figure 54. Like the Canadian movement it is comparatively stable and lacks the violent fluctuations that characterize the exports to more distant countries. Over the 20-year period the exports to this group of destinations have been diminishing largely because of the competition of fuel oil.

In 1929 exports to this group of countries amounted to 1,500,000 tons, a slight increase over 1928 but a decrease of more than a million tons compared with 1913.

OVERSEAS EXPORTS

In sharp contrast to the comparatively stable movements to Canada and the Caribbean the exports overseas have been subject to violent and unpredictable fluctuations. In view of recent efforts to stimulate the export trade the record of this overseas movement has been of especial interest. The total is shown by the curve in Figure 54, and details by continents are given in Table 78. The record proves clearly that except when the normal competition of British and German coal has been shut off the overseas movement of American coal has been small. Before the World War the overseas exports ran about a million tons a year. In the fiscal year 1912, when partly stimulated by a two months' stoppage in Great Britain, they amounted to 1,472,000. A fairer measure of the pre-war movement was the fiscal year 1913 when with Great Britain and Germany both competing actively the overseas shipments were 1,389,000 tons. The immediate effect of the World War was to stimulate the movement overseas by cutting off exports from Germany and by interfering with British shipping. The ultimate effect was to curtail exports as the submarine warfare cut more and more deeply into the world's supply of shipping. By the close of the war stocks in Europe had been reduced to the vanishing point, and in 1919 substantial purchases were made to rebuild the depleted reserves. In the meantime many of the French mines had been destroyed in the war and some years would be required to restore them. District strikes in Britain during July and August further reinforced the demand for American coal, and the total shipments overseas in 1919 rose to 6,538,000 tons. The following year a panic swept the world's coal trade. A decision of the British Government to limit exports in view of a shortage at home and a sudden increase in world demand started a speculative boom in exports from the United States. The boom came at a time when American stocks were dangerously low and when an outlaw strike of the railway switchmen had created an acute shortage of cars. Spot prices at the seaboard rose as high as $25 a ton; and the fever was transmitted to the internal markets, even to those beyond the Mississippi. The tonnage shipped overseas in 1920 climbed to a peak of 19,939,000 tons. The year 1921 was one of industrial depression, but a hangover of the extraordinary demand of the year before and a 3-month strike of the British miners sustained the overseas demand. From the heights of 1920–21 exports plunged to barely 600,000 tons as the great strike of the American miners in 1922 dealt the overseas movement a staggering blow. In 1923, however, American exporters received a windfall of unexpected business through the French occupation of the Ruhr, the effects of which were felt well into the following year. In 1926 a tremendous strike occurred in Britain, during which most of the miners in the United Kingdom were idle for seven months, and the vacuum created caused our shipments overseas to shoot up to another peak like that of 1920.

Spot prices advanced sharply, although much less than in 1920, and once again the export demand set the tone of the internal markets of the country. The total shipped overseas in 1926 was 19,803,000 tons, of which 15,805,000 went to Europe alone. So great was the shortage created by the strike that it carried over into the early weeks of 1927.

This series of accidents in the ocean-borne coal trade at length came to an end. In 1928 American exporters were exposed to the full pressure of European competition, and the shipments overseas fell to 681,000 tons. They increased slightly in 1929. For that year the total was 1,202,000 tons, or approximately the same quantity as in the beginning of the 20-year period.

Ten years of postwar experience have thus shown that labor disputes on one side of the Atlantic or the other are the chief cause of the speculative uncertainties of the ocean-borne trade, and that except during shortages in Europe the overseas demand for American coal has been small.

TABLE 78.—*Exports of bituminous coal to (1) Canada and Mexico, (2) the West Indies and Central America, and (3) "overseas" destinations, 1910–1929*

[Figures represent thousands of net tons]

Year	(1) Canada and Mexico	(2) West Indies, and Central America [1]	(3) "Overseas" (all other countries)							Grand total
			Newfoundland Miquelon, and Bermuda	South America	Europe	Asia	Africa	Oceania	Total "overseas"	
Fiscal years:										
1910	8,846	1,999	24	197	390	17	3	187	818	11,663
1911	10,357	2,266	22	205	284	6	66	54	637	13,260
1912	12,338	2,665	22	650	454	8	338	--------	1,472	16,475
1913	13,918	2,706	40	494	533	--------	263	59	1,389	18,013
1914	13,181	2,392	38	647	1,034	--------	246	52	2,017	17,590
1915	9,876	2,145	27	1,453	2,308	19	274	41	4,122	16,143
1916	11,984	2,602	46	2,061	4,025	18	264	--------	6,414	21,000
Calendar years:										
1916	13,481	2,473	53	2,476	2,529	18	225	--------	5,301	21,255
1917	18,327	2,748	49	1,606	997	--------	113	--------	2,765	23,840
1918	18,316	2,477	25	1,465	49	--------	19	--------	1,558	22,351
1919	12,063	1,513	27	1,666	4,585	15	189	56	6,538	20,114
1920	16,458	2,120	83	3,948	14,741	32	1,095	40	19,939	38,517
1921	13,589	1,095	42	1,759	5,515	49	1,005	77	8,447	23,131
1922	10,937	852	18	344	171	--------	91	--------	624	12,413
1923	16,960	1,021	64	585	2,678	3	122	21	3,473	21,454
1924	12,746	1,282	125	1,252	1,520	17	146	12	3,072	17,100
1925	13,548	1,513	135	917	1,161	8	177	3	2,401	17,462
1926	13,763	1,706	122	2,730	15,805	30	1,107	9	19,803	35,272
1927	14,723	1,543	102	741	793	22	88	--------	1,746	18,012
1928	14,049	1,434	99	273	255	1	53	--------	681	16,164
1929	14,727	1,500	211	332	567	8	84	--------	1,202	17,429

[1] Includes Bahamas, Virgin Islands, and Panama.

TABLE 79.—*Bituminous coal exported, by countries, 1925–1929, in net tons* [1]

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country	1925	1926	1927	1928	1929
North America:					
Bermuda	13, 470	23, 122	18, 031	11, 554	15, 149
British Honduras	391	562	419	510	109
Canada	13, 421, 007	13, 633, 513	14, 594, 297	13, 958, 961	14, 645, 001
Central America—					
Costa Rica	2	5, 657	5, 788	221	2, 494
Guatemala	3, 401	430	716	755	899
Honduras	2, 018	1, 302	988	1, 352	1, 303
Nicaragua	2, 567	5, 126	602	6, 171	410
Panama	349, 312	445, 305	398, 930	296, 067	340, 879
Salvador	69	128	157	134	66
Mexico	125, 804	128, 633	129, 248	91, 319	82, 480
Miquelon and St. Pierre Islands	12, 443	14, 885	16, 016	3, 735	30, 314
Newfoundland and Labrador	109, 659	83, 545	68, 301	82, 703	166, 028
West Indies—					
British—					
Barbados	37, 583	39, 334	19, 370	32, 638	18, 016
Jamaica	56, 073	159, 533	55, 746	69, 552	75, 991
Trinidad and Tobago	26, 180	59, 353	60, 022	75, 690	86, 188
Other British	36, 745	50, 079	28, 581	22, 942	44, 066
Cuba	694, 125	615, 721	636, 617	599, 600	604, 709
Dominican Republic	8, 028	13, 588	9, 891	1, 192	1, 696
French	139, 385	127, 047	153, 766	154, 012	147, 836
Haiti	67	8, 143	838	187	3
Netherland	86, 090	81, 189	55, 570	47, 668	32, 390
Virgin Islands of the United States	70, 743	95, 118	113, 614	125, 584	142, 233
	15, 195, 162	15, 591, 313	16, 367, 508	15, 582, 547	16, 438, 260
South America:					
Argentina	164, 712	1, 115, 526	236, 018	36, 165	48, 502
Bolivia	----------	14, 112	----------	----------	----------
Brazil	657, 888	1, 333, 640	419, 709	172, 795	227, 778
Chile	27, 280	3, 405	3, 938	----------	224
Colombia	1, 581	18, 669	288	323	178
Ecuador	1, 157	9, 088	293	521	38
Falkland Islands	----------	11, 862	5, 716	16, 504	----------
Guiana—					
British	17, 352	21, 703	11, 667	11, 124	10, 133
French	258	----------	----------	----------	----------
Surinam (Netherland)	2, 726	5, 645	12, 629	11, 253	6, 774
Peru	21, 462	29, 683	16, 912	4, 530	18, 431
Uruguay	22, 194	145, 601	33, 179	19, 306	19, 072
Venezuela	811	20, 592	551	523	599
	917, 421	2, 729, 526	740, 900	273, 044	331, 729
Europe:					
Azores and Madeira Islands	----------	23, 057	----------	----------	----------
Denmark	----------	68, 346	250	----------	----------
France	261, 751	544, 145	119, 642	23, 113	20, 922
Germany	6, 896	1, 273	130	560	1, 279
Gibraltar	----------	192, 245	14, 324	----------	----------
Greece	----------	28, 925	----------	----------	----------
Iceland and Faroe Islands	----------	4, 716	----------	----------	----------
Irish Free State	----------	769, 849	19, 757	363	----------
Italy	871, 454	1, 727, 057	359, 654	228, 656	544, 505
Latvia	----------	8, 716	----------	----------	----------
Malta, Gozo, etc	----------	30, 903	----------	----------	----------
Netherlands	----------	31, 674	----------	----------	----------
Norway	2, 402	92, 133	473	----------	----------
Poland and Danzig	----------	4, 514	----------	----------	----------
Portugal	----------	163, 372	36, 052	----------	----------
Spain	----------	18, 751	----------	----------	----------
Sweden	----------	5, 027	----------	----------	----------
Turkey in Europe	----------	40, 754	----------	----------	----------
United Kingdom	18, 124	12, 048, 062	237, 198	2, 274	573
Yugoslavia and Albania	----------	1, 724	5, 039	----------	----------
	1, 160, 627	15, 805, 243	792, 519	254, 966	567, 279
Asia:					
Aden	----------	----------	3, 380	22	----------
Arabia	----------	----------	3, 382	----------	----------
British Malaya	----------	----------	3, 525	----------	1, 957
China	3, 006	----------	----------	----------	----------
East Indies—					
British India	4, 492	----------	----------	----------	----------
Netherland	----------	3, 418	----------	----------	----------
Japan	----------	194	----------	----------	6, 132
Palestine and Syria	----------	15, 811	----------	----------	----------
Persia	----------	----------	----------	6	----------
Philippine Islands	----------	10, 470	12, 136	1, 120	----------
Soviet Russia in Asia	11	----------	11	----------	118
	7, 509	29, 893	22, 434	1, 148	8, 207

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[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in the foreign trade, which aggregated, in 1926, 7,735,606 tons; in 1927, 4,565,278 tons; in 1928, 4,294,223 tons; and in 1929, 4,286,519 tons.

TABLE 79.—*Bituminous coal exported, by countries, 1925–1929, in net tons*—Con.

Country	1925	1926	1927	1928	1929
Africa:					
Algeria and Tunisia	35, 607	152, 731	7, 339	7, 166	37, 717
British—					
East				1, 038	
South, Union of				56	
West	23, 064	20, 854	9, 588		
Other					108
Canary Islands		290, 303			
Egypt	40, 018	359, 434	71, 431	44, 514	45, 958
French	78, 677	122, 185			
Liberia		11			1
Morocco		19, 706			
Portuguese—					
Mozambique		3, 920			
Other Portuguese		137, 392			
	177, 366	1, 106, 536	88, 358	52, 774	83, 784
Oceania:					
British—					
Australia	3, 474	8, 298			39
New Zealand		1, 128			
French	1		25	6	
	3, 475	9, 426	25	6	39
Grand total	17, 461, 560	35, 271, 937	18, 011, 744	16, 164, 485	17, 429, 298

TABLE 80.—*Bituminous coal exported, by districts and ports, 1925–1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Customs district	Principal ocean port or rail gateway	1925	1926	1927	1928	1929
North Atlantic:						
Massachusetts	Boston	692	3	20	2, 284	
Rhode Island				3		11
New York	New York	15, 711	108, 993	11, 265	9, 992	12, 353
Philadelphia	Philadelphia	194, 706	2, 224, 058	340, 011	122, 792	198, 592
Maryland	Baltimore	336, 855	6, 465, 788	392, 366	193, 788	357, 872
Virginia	Hampton Roads	4, 260, 319	12, 205, 095	2, 587, 847	1, 858, 345	2, 169, 134
South Atlantic:						
South Carolina	Charleston	185, 833	580, 708	230, 609	92, 688	93, 633
Georgia	Savannah	196				
Florida	Pensacola	11, 629	57, 761	1, 852	480	13, 273
Mobile	Mobile	45, 969	35, 991	26, 905	23, 974	15, 406
New Orleans	New Orleans	5, 547	54, 678	3, 796	5, 470	4, 575
Galveston			876	488	103	262
Sabine		853	39			
Mexican border:						
Arizona		62, 821	67, 290	77, 351	33, 419	30, 625
El Paso		33, 950	46, 050	36, 478	42, 334	32, 826
San Antonio		2, 029	2, 326	2, 820	1, 511	1, 243
Pacific coast:						
Washington [1]		58, 223	35, 723	21, 164	24, 045	31, 854
San Francisco		797	645	245	114	128
Los Angeles		96	54	317	149	474
Lake Erie ports: Ohio [2]	Lower lake docks	5, 244, 332	5, 730, 535	6, 223, 502	6, 601, 978	6, 616, 476
Rail gateways on Canadian border:						
Eastern—						
Maine and New Hampshire.		41, 580	50, 173	40, 389	29, 107	46, 870
Vermont		3, 545	6, 208	6, 035	4, 786	6, 994
St. Lawrence		1, 548, 817	1, 502, 247	1, 776, 907	1, 289, 755	1, 058, 804
Rochester [3]		572, 423	798, 741	781, 850	1, 520, 669	2, 144, 239
Buffalo		2, 569, 142	2, 819, 487	2, 950, 844	2, 290, 730	2, 556, 917
Michigan		2, 088, 046	2, 290, 484	2, 303, 082	1, 882, 254	1, 959, 518
Western—						
Duluth, Superior, and International Falls.		70, 794	97, 815	107, 078	74, 530	43, 137
Dakota		106, 503	89, 942	88, 013	58, 889	33, 540
Montana-Idaho			1	6		270
Miscellaneous:						
Alaska		16	11	235	69	151
Porto Rico		136	215	266	230	121
		17, 461, 560	35, 271, 937	18, 011, 744	16, 164, 485	17, 429, 298

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[1] Both rail to Canada and by tide to foreign ports.

[2] Lower lake docks as follows: Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, Conneaut, and Erie.

[3] Rail, car ferry, and Lake Ontario.

TABLE 81.—*Anthracite exported, by countries, 1925–1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country	1925	1926	1927	1928	1929
North America:					
Bermuda	1,639	896	1,644	2,098	346
British Honduras	353	468		787	1
Canada	3,096,815	3,941,718	3,238,564	3,296,487	3,376,303
Central America—					
Costa Rica		28		2	
Guatemala	106	141	942	966	25
Honduras	45	96	84	210	78
Nicaragua	115	1			683
Panama	920	463	684	435	
Salvador		16	20	21	152
Mexico	809	5,233	8,605	1,674	1,887
Miquelon and St. Pierre Islands		389	652	105	256
Newfoundland and Labrador	10,781	21,690	17,678	17,168	13,537
West Indies—					
British—					
Barbados		116	56	56	28
Jamaica	36	29			19
Trinidad and Tobago		336			
Other British	204	304	148	232	84
Cuba	64,994	55,029	50,202	10,887	11,480
Dominican Republic	2,091	702	18	65	62
Haiti		1			1
Netherland		75	150	69	321
Virgin Islands of the United States			33		
	3,178,908	4,027,731	3,319,480	3,331,262	3,405,263
South America:					
Argentina		123	179	4	
Bolivia		189			
Chile	3				22
Colombia	88	78	802	197	32
Ecuador				56	125
Guiana—British		569			
Peru	4				
Uruguay		225	94		
Venezuela	3	37	39	35	40
	98	1,221	1,114	292	219
Europe:					
Azores and Madeira Islands		10			
France			518	1	12
Germany					1
Greece		11			
Italy		112			2
Portugal		152			
United Kingdom		401	4,393	3,463	1
		686	4,911	3,464	16
Asia:					
Japan		45			
Philippine Islands				11	
Soviet Russia				10	
		45		21	
Africa:					
Liberia			2	1	1
Mozambique					836
Portuguese, other				1,231	
			2	1,232	837
Oceania:					
Australia					34
French				1	
				1	34
Grand total	3,179,006	4,029,683	3,325,507	3,336,272	3,406,369

TABLE 82.—*Anthracite exported, by districts and ports, 1925–1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Customs district	Principal ocean port or rail gateway	1925	1926	1927	1928	1929
North Atlantic:						
Massachusetts	Boston	477	441	619	454	256
Rhode Island				5		
New York	New York	80, 117	115, 526	100, 422	77, 215	78, 972
Philadelphia	Philadelphia	73, 940	80, 897	57, 430	29, 111	37, 382
Maryland	Baltimore		41		1, 014	256
Virginia	Hampton Roads		84	5, 863	101	858
		154, 534	196, 989	164, 339	107, 895	117, 724
South Atlantic:						
Georgia	Savannah	44		221		
Florida	Pensacola	2	101	8	40	8
Mobile	Mobile		96		50	1
New Orleans	New Orleans	165	143	84	268	209
Sabine						29
		211	340	313	358	247
Mexican border:						
Arizona		29	2, 379	513	85	179
El Paso		637	1, 458	7, 115	726	1, 277
San Antonio		73	1, 197	862	833	236
		739	5, 034	8, 490	1, 644	1, 692
Pacific coast:						
Washington		30	231	748	3, 360	1, 191
San Francisco			16	20	32	116
Los Angeles		36	103	82	16	78
		66	350	850	3, 408	1, 385
Lake Erie ports: Ohio [1]	Lower lake docks	17, 664	20, 558	409	9, 130	8, 754
Rail gateways on Canadian border:						
Eastern—						
Maine and New Hampshire		340	675	157	206	3, 157
Vermont		3, 086	3, 633	7, 748	3, 249	4, 277
St. Lawrence		985, 145	1, 505, 343	1, 266, 400	1, 242, 595	1, 137, 881
Rochester [2]		205, 556	222, 584	164, 213	237, 314	177, 648
Buffalo		1, 769, 625	2, 041, 218	1, 691, 599	1, 708, 010	1, 937, 374
Michigan		8, 961	14, 792	5, 841	11, 859	5, 347
		2, 972, 713	3, 788, 245	3, 135, 958	3, 203, 233	3, 265, 684
Western—						
Duluth, Superior, and International Falls		12, 225	5, 615	5, 984	4, 403	3, 898
Dakota		20, 854	12, 552	9, 130	6, 201	6, 985
Montana-Idaho				2		
		33, 079	18, 167	15, 116	10, 604	10, 883
Miscellaneous: Porto Rico				32		
Grand total		3, 179, 006	4, 029, 683	3, 325, 507	3, 336, 272	3, 406, 369

[1] Chiefly Buffalo and Erie.

[2] Rail, car ferry, and Lake Ontario.

TABLE 83.—*Anthracite and bituminous coal exported to Canada and to all other countries, by months, 1928 and 1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

	January	February	March	April	May	June	July	August	September	October	November	December	Year
1928													
Anthracite:													
Canada	255, 335	244, 713	209, 963	198, 671	291, 862	231, 501	186, 216	308, 087	292, 188	450, 694	339, 725	287, 532	3, 296, 487
All other	3, 953	5, 200	1, 139	5, 316	6, 405	2, 999	1, 135	3, 017	2, 838	2, 791	2, 851	2, 141	39, 785
	259, 288	249, 913	211, 102	203, 987	298, 267	234, 500	187, 351	311, 104	295, 026	453, 485	342, 576	289, 673	3, 336, 272
Bituminous (not including bunker coal):													
Canada	711, 371	675, 567	700, 765	632, 005	1, 107, 879	1, 277, 612	1, 468, 012	1, 646, 799	1, 598, 667	1, 532, 594	1, 617, 868	989, 822	13, 958, 961
All other	242, 349	217, 071	146, 428	164, 548	173, 877	152, 452	214, 872	151, 945	168, 873	144, 308	193, 696	235, 105	2, 205, 524
	953, 720	892, 638	847, 193	796, 553	1, 281, 756	1, 430, 064	1, 682, 884	1, 798, 744	1, 767, 540	1, 676, 902	1, 811, 564	1, 224, 927	16, 164, 485
Fuel or bunker coal loaded on vessels engaged in foreign trade	356, 897	299, 574	341, 824	343, 224	407, 278	360, 900	351, 427	399, 012	350, 025	372, 414	374, 170	337, 478	4, 294, 223
1929													
Anthracite:													
Canada	330, 700	305, 946	173, 131	177, 138	273, 393	209, 900	220, 898	245, 404	354, 364	441, 991	297, 663	345, 775	3, 376, 303
All other	2, 891	753	998	2, 182	2, 585	1, 661	292	3, 138	7, 673	1, 717	1, 293	4, 883	30, 066
	333, 591	306, 699	174, 129	179, 320	275, 978	211, 561	221, 190	248, 542	362, 037	443, 708	298, 956	350, 658	3, 406, 369
Bituminous (not including bunker coal):													
Canada	813, 281	720, 121	744, 276	726, 085	1, 358, 362	1, 672, 358	1, 718, 847	1, 386, 661	1, 622, 882	1, 548, 693	1, 398, 326	935, 109	14, 645, 001
All other	213, 891	175, 941	240, 298	226, 691	211, 749	255, 074	229, 490	226, 524	204, 282	255, 066	266, 324	278, 967	2, 784, 297
	1, 027, 172	896, 062	984, 574	952, 776	1, 570, 111	1, 927, 432	1, 948, 337	1, 613, 185	1, 827, 164	1, 803, 759	1, 664, 650	1, 214, 076	17, 429, 298
Fuel or bunker coal loaded on vessels engaged in foreign trade	318, 185	298, 825	316, 747	404, 569	378, 120	351, 368	394, 253	379, 207	388, 396	383, 995	373, 172	299, 682	4, 286, 519

SHIPMENTS TO ALASKA, HAWAII, AND PORTO RICO

In addition to the export trade proper the United States supplies by sea a small tonnage to the Territories of Alaska, Hawaii, and Porto Rico. As shown in Table 84 the movement to Alaska is relatively steady, but that to Hawaii and Porto Rico tends to fluctuate within wide limits. In 1929, 36,694 tons was shipped coastwise to Alaska, 6,607 tons to Hawaii, and 53,096 tons to Porto Rico.

TABLE 84.—*Shipments of coal to Alaska, Hawaii, and Porto Rico, 1919–1929, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Year	Alaska (all coal)	Hawaii (all coal)	Porto Rico (all coal)	Year	Alaska (all coal)	Hawaii (all coal)	Porto Rico (all coal)
1919	57,166	42,495	83,492	1925	37,324	4,906	72,224
1920	38,128	17,634	104,021	1926	35,620	10,885	120,457
1921	24,278	9,249	55,800	1927	39,443	7,870	54,311
1922	28,457	846	55,356	1928	39,184	2,549	31,641
1923	34,082	25,344	49,302	1929	36,694	6,607	53,096
1924	40,161	49,074	58,434				

WORLD PRODUCTION OF COAL

A new record in the world production of coal was established in 1929. The total output of all grades was 1,559,000,000 metric tons. Of this amount approximately 231,000,000 tons was lignite and 1,328,000,000 bituminous coal and anthracite. The production of lignite has been growing rapidly in recent years, especially in Germany, and in comparison with that in 1913 it now shows an increase of 79 per cent. Production of bituminous and anthracite showed no consistent gain from 1913 to 1926, although in the last three years it has run somewhat above the pre-war level. Even the 1929 output was much less than might have been expected if the steady gain of the generation before the World War had continued. (See fig. 55.) A combination of factors has caused a world-wide depression in the industry, among them increasing fuel efficiency, successful competition of water power and petroleum, a slowing down in the growth of iron manufacture, and the economic disorganization caused in some countries by the war.

Table 86 gives the production of coal by countries from 1925 to 1929. It is based upon official reports, supplemented where necessary by trade information. Similar data by countries for 1888 to 1912 will be found in Coal in 1925, pages 491 to 494; for 1913 to 1922 in Coal in 1922, pages 575 to 577; and for 1923 and 1924 in Coal in 1926, pages 532 to 533.

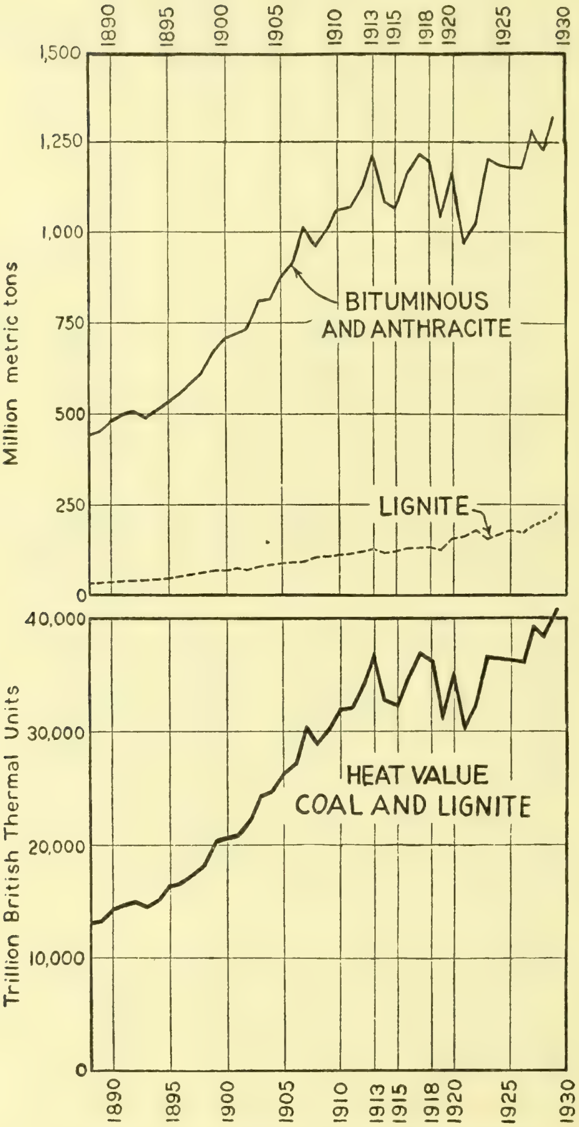

FIGURE 55.—World production of coal and lignite, 1888–1929

Table 85.—*World production of coal and lignite, 1888–1929*

[All countries known to have produced coal are included. Estimates are included for China in the years 1888 to 1905 and for certain of the very small producing countries in the years for which no data were obtainable, but in no year does the tonnage estimated exceed 1.1 per cent of the total]

Year	Million metric tons			Heat value		Year	Million metric tons			Heat value	
	Coal	Lignite	Total	Trillion B. t. u.	Index numbers 1913=100		Coal	Lignite	Total	Trillion B. t. u.	Index numbers, 1913=100
1888	442	33	475	13, 226	36. 0	1909	1, 009	106	1, 115	30, 540	83. 2
1889	450	36	486	13, 513	36. 8	1910	1, 059	107	1, 166	32, 001	87. 1
1890	478	38	516	14, 343	39. 1	1911	1, 074	111	1, 185	32, 471	88. 4
1891	498	40	538	14, 942	40. 7	1912	1, 128	120	1, 248	34, 141	93. 0
1892	503	41	544	15, 098	41. 1	1913	1, 213	129	1, 342	36, 724	100. 0
1893	491	43	534	14, 795	40. 3	1914	1, 086	121	1, 207	32, 941	89. 7
1894	514	45	559	15, 498	42. 2	1915	1, 069	124	1, 193	32, 476	88. 4
1895	542	48	590	16, 331	44. 5	1916	1, 159	132	1, 291	35, 164	95. 8
1896	557	51	608	16, 806	45. 8	1917	1, 223	133	1, 356	37, 015	100. 8
1897	584	55	639	17, 636	48. 0	1918	1, 198	135	1, 333	36, 301	98. 8
1898	614	59	673	18, 565	50. 6	1919	1, 044	129	1, 173	31, 799	86. 6
1899	673	62	735	20, 297	55. 3	1920	1, 166	153	1, 319	35, 637	97. 0
1900	708	69	777	21, 386	58. 2	1921	970	164	1, 134	30, 104	82. 0
1901	725	75	800	21, 967	59. 8	1922	1, 047	181	1, 228	32, 536	88. 6
1902	741	73	814	22, 395	61. 0	1923	1, 198	161	1, 359	36, 647	99. 8
1903	813	76	889	24, 509	66. 7	1924	1, 186	171	1, 357	36, 445	99. 2
1904	820	79	899	24, 746	67. 4	1925	1, 187	185	1, 372	36, 624	99. 7
1905	865	84	949	26, 102	71. 1	1926	1, 179	185	1, 364	36, 399	99. 1
1906	924	90	1, 014	27, 884	75. 9	1927	1, 277	200	1, 477	39, 419	107. 3
1907	1, 019	99	1, 118	30, 748	83. 7	1928	1, 248	216	1, 464	38, 771	105. 6
1908	964	105	1, 069	29, 236	79. 6	1929	1, 328	231	1, 559	41, 286	112. 4

Table 86.—*Coal and lignite produced in the principal countries of the world in the calendar years 1925–1929, in metric tons*

[Compiled by L. M. Jones, of the Bureau of Mines]

Country	1925	1926	1927	1928	1929
North America:					
Canada—					
Coal	8, 627, 519	11, 687, 032	12, 340, 507	12, 439, 470	12, 272, 806
Lignite	3, 288, 262	3, 261, 599	3, 468, 793	3, 494, 505	3, 599, 720
Greenland	2, 100	1, 500	2, 900	3, 000	3, 600
Mexico	1, 444, 498	1, 309, 138	1, 031, 308	1, 022, 475	1, 054, 196
United States—					
Anthracite	56, 079, 281	76, 599, 968	72, 661, 094	68, 354, 261	66, 975, 462
Bituminous and lignite	471, 781, 446	520, 147, 061	469, 704, 558	454, 265, 822	485, 330, 952
South America:					
Argentina	(1)	(1)	(1)	(1)	(1)
Brazil	392, 376	[2] 400, 000	[2] 400, 000	[2] 400, 000	[2] 400, 000
Chile	1, 453, 228	1, 490, 509	1, 481, 511	1, 375, 616	1, 325, 611
Colombia	(1)	(1)	(1)	(1)	(1)
Peru	100, 681	170, 070	158, 601	177, 513	219, 654
Venezuela [3]	16, 798	15, 928	16, 104	15, 812	16, 859
Europe:					
Albania—Lignite	(1)	1, 578	3, 056	3, 038	[2] 3, 000
Austria—					
Coal	145, 200	157, 308	175, 601	202, 098	208, 020
Lignite	3, 033, 378	2, 957, 728	3, 064, 068	3, 262, 570	3, 524, 792
Belgium	23, 097, 040	25, 259, 600	27, 550, 960	27, 578, 300	26, 931, 460
Bulgaria—					
Coal	73, 000	62, 150	69, 192	70, 336	72, 478
Lignite	1, 156, 006	1, 140, 093	1, 168, 454	1, 360, 790	1, 572, 964
Czechoslovakia—					
Coal	12, 558, 992	14, 176, 998	14, 016, 300	14, 560, 305	16, 521, 457
Lignite	18, 604, 678	18, 515, 666	19, 620, 637	20, 451, 421	22, 560, 796
France—					
Coal	47, 097, 297	51, 391, 523	51, 778, 530	51, 365, 427	53, 736, 497
Lignite	993, 352	1, 061, 122	1, 067, 290	1, 074, 627	1, 187, 406

[1] Estimate included in total.

[2] Approximate production.

[3] Exclusive of output of State of Falcon (about 8,000 tons), for which estimate is included in total.

TABLE 86.—*Coal and lignite produced in the principal countries of the world in the calendar years 1925–1929, in metric tons*—Continued

Country	1925	1926	1927	1928	1929
Europe—Continued.					
Germany [4]—					
Coal	132,622,125	145,295,724	153,599,355	150,860,599	163,437,056
Lignite	139,724,614	139,150,557	150,503,914	165,588,097	175,177,932
Saar [5]	12,989,850	13,680,874	13,595,824	13,106,718	13,579,348
Greece—Lignite	142,076	153,321	143,346	120,639	(1)
Hungary—					
Coal	805,050	827,710	785,922	783,279	826,270
Lignite	5,518,607	5,822,159	6,244,275	6,510,070	6,993,940
Irish Free State	(1)	79,715	(1)	(1)	(1)
Italy—					
Coal	188,522	209,260	168,528	127,932	215,640
Lignite	1,105,474	1,181,342	912,458	697,033	740,240
Netherlands—					
Coal	7,116,970	8,842,687	9,488,412	10,920,054	11,581,202
Lignite	207,623	211,194	201,382	196,696	156,568
Poland—					
Coal	29,081,327	35,747,348	38,084,086	40,616,384	46,236,037
Lignite	65,675	76,026	78,464	73,560	74,321
Portugal—					
Coal	123,450	201,732	178,554	201,348	196,901
Lignite	16,970	30,699	25,713	26,450	29,343
Rumania—					
Coal	313,572	322,191	373,457	397,564	370,947
Lignite	2,615,278	2,731,362	2,850,011	2,629,676	2,675,080
Russia [6]—					
Coal	13,354,011	20,614,717	25,944,341	30,566,000	38,423,000
Lignite	983,020	1,605,327	1,763,196		
Spain—					
Coal	6,117,342	6,536,087	6,562,936	6,370,508	7,058,316
Lignite	402,690	399,830	429,602	422,504	438,951
Svalbard (Spitsbergen)	[7] 413,412	[7] 291,211	[7] 303,000	[7] 274,000	[8] 236,000
Sweden	263,879	383,673	398,298	358,513	394,975
Switzerland	(1)	(1)	[2] 7,000	[2] 7,000	[2] 7,000
Turkey—Lignite	2,000	4,638	4,000	(1)	312
United Kingdom—					
Great Britain	247,079,210	128,305,291	255,264,615	241,283,355	262,046,206
Northern Ireland—Lignite	(1)	(1)	510	650	327
Yugoslavia—					
Coal	178,456	190,814	287,728	457,472	408,611
Lignite	3,973,870	3,976,938	4,458,481	4,694,408	5,242,527
Asia:					
British Borneo	101,904	92,583	80,466	79,721	73,100
China	24,255,000	23,040,119	24,172,009	25,091,760	(1)
Chosen	634,257	682,896	709,578	815,817	937,902
Federated Malay States	414,634	471,736	470,432	565,523	672,131
India, British	21,239,892	21,336,204	22,436,757	22,904,685	22,495,347
Indo-China—					
Coal	1,357,231	1,284,661	1,482,900	1,954,098	1,941,310
Lignite	5,739	5,598	7,000	15,472	30,713
Japan—					
Japan proper—					
Coal	31,369,538	31,296,168	33,387,160	33,694,298	(1)
Lignite	169,426	161,134	178,613	121,923	(1)
Karafuto	250,615	275,823	357,046	539,481	632,930
Taiwan	1,704,581	1,794,511	1,857,257	1,583,598	1,530,025
Netherland East Indies	1,400,725	1,466,359	1,620,205	1,703,526	1,831,504
Philippine Islands	48,681	28,577	23,410	27,857	17,321
Russia [6]—					
Coal	[9] 1,611,793	[9] 2,849,399	[9] 3,907,499	4,675,000	5,489,000
Lignite	[9] 533,880	[9] 694,366	[9] 869,262		
Sakhalin	17,762	19,624	46,274		
Straits Settlements (Labuan)	41	-----	-----	-----	-----
Turkey—					
Coal	703,444	1,222,387	[10] 896,074	[10] 923,403	[10] 985,035
Lignite	4,062	7,569	6,555	5,169	7,659
Africa:					
Algeria	10,037	13,731	21,269	16,631	16,128
Belgian Congo—					
Coal	65,100	90,250	86,950	97,780	102,500
Lignite	-----	-----	-----	-----	2,800
Madagascar	-----	-----	5	33	26

[1] Estimate included in total.
[2] Approximate production.
[4] Exclusive of mines in the Saar under French control.
[5] Mines under French control.
[6] Year ended Sept. 30.
[7] Production less consumption at mines, for which data are not available.
[8] Exports.
[9] Exclusive of Sakhalin.
[10] Shipments.

TABLE 86.—*Coal and lignite produced in the principal countries of the world in the calendar years 1925–1929, in metric tons*—Continued

Country	1925	1926	1927	1928	1929
Africa—Continued.					
Nigeria	242,833	329,784	363,643	365,083	[11] 352,686
Portuguese East Africa	18,086	10,868	15,834	6,455	(1)
Southern Rhodesia	689,201	874,140	908,744	1,094,843	1,036,816
Union of South Africa	12,321,728	12,949,950	12,580,314	12,606,576	13,018,328
Oceania:					
Australia—					
New South Wales	11,579,108	11,060,483	11,304,688	9,599,841	7,740,000
Queensland	1,196,067	1,240,657	1,116,680	1,093,615	1,390,713
Tasmania	83,009	104,000	113,854	130,562	132,382
Victoria—					
Coal	542,821	600,487	695,227	668,889	715,124
Lignite	890,535	973,310	1,478,842	1,617,407	1,769,122
Western Australia	444,482	482,440	509,554	536,901	553,462
New Caledonia	1,300	15,000	(1)	16,500	(1)
New Zealand—					
Coal	1,061,494	1,215,590	1,311,247	1,370,379	1,389,107
Lignite	1,087,447	1,060,361	1,093,484	1,105,483	1,187,458
Total, all grades	1,372,000,000	1,364,000,000	1,477,000,000	1,464,000,000	1,559,000,000
Lignite (total of items shown above)	185,000,000	185,000,000	200,000,000	216,000,000	231,000,000
Bituminous and anthracite (by subtraction)	1,187,000,000	1,179,000,000	1,277,000,000	1,248,000,000	1,328,000,000

[1] Estimate included in total.

[11] Year ended Mar. 31 of year following that stated.

DETAILED STATISTICS OF BITUMINOUS COAL, BY STATES AND COUNTIES

TABLES OF PRODUCTION, VALUE, MEN EMPLOYED, DAYS WORKED, AND OUTPUT PER MAN IN 1929

The following table (Table 87) presents detailed statistics for each coal-producing county from which three or more operators reported production. If less than three reports were received the figures for two or more counties have been combined to avoid disclosing individual returns, unless permission to publish has been granted by the producers.

The series gives the details of total value of product, average value per ton, men employed by broad occupational groups, average number of days worked by the mines, and output per man per day. The figures include stripping operations as well as deep mines. Separate particulars for the stripping operations in each county are given in Table 49. If the reader will deduct the stripping figures as given in that table from the totals for all mines in the following table, he will find that the remainder represents the operations of the deep mines. By this means figures can be obtained for the deep mines separately in any State or county desired.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*

[Note that figures relate only to active mines of commercial size; no canvass made of wagon mines producing less than 1,000 tons]

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
ALABAMA														
Bibb	1,010,484	5,816	26,124	----------	1,042,424	$2,441,000	$2.34	1,206	163	214	219	1,802	196	2.96
Blount	381,391	3,929	5,933	----------	391,253	899,000	2.30	499	85	21	98	703	220	2.53
Cullman and St. Clair	735,351	22,509	39,041	----------	796,901	1,749,000	2.19	682	92	102	152	1,028	251	3.09
Fayette and Marion	450,163	1,846	253	----------	452,262	1,137,000	2.51	481	61	50	120	712	221	2.88
Jefferson	8,638,706	161,036	84,642	----------	8,884,384	18,400,000	2.07	6,882	1,476	1,735	1,451	11,544	252	3.05
Shelby	749,633	38,658	409	----------	788,700	2,395,000	3.04	991	130	70	265	1,456	251	2.16
Tuscaloosa	513,641	12,303	720	----------	526,664	1,169,000	2.22	542	67	125	138	872	213	2.83
Walker	4,979,480	69,060	9,677	----------	5,058,217	9,113,000	1.80	3,992	885	925	1,271	7,073	205	3.50
Winston	600	2,518	----------	----------	3,118	6,000	1.92	12	2	2	2	18	128	1.35
	17,459,449	317,675	166,799	----------	17,943,923	37,309,000	2.08	15,287	2,961	3,244	3,716	25,208	231	3.08
ALASKA														
Total	94,600	5,010	1,000	----------	100,610	$528,000	$5.25	50	10	24	68	152	174	3.81
ARIZONA														
Total	----------	10,060	72	----------	10,132	$44,000	$4.34	33	2	2	2	39	137	1.90

ARKANSAS

Franklin	256, 504	3, 616	3, 250		263, 370	$716, 000	$2. 72	305	46	23	168	542	129	3. 76
Johnson	321, 433	769	3, 674		325, 876	1, 309, 000	4. 02	774	113	98	224	1, 209	126	2. 14
Logan	262, 003	2, 863	368		265, 234	1, 167, 000	4. 40	650	42	43	86	821	127	2. 54
Sebastian	704, 715	12, 173	2, 140		719, 028	1, 817, 000	2. 53	966	176	136	155	1, 433	169	2. 98
Other counties (Pope and Scott)	114, 918	6, 599	83		121, 600	615, 000	5. 06	211	35	16	32	294	203	2. 04
	1, 659, 573	26, 020	9, 515		1, 695, 108	5, 624, 000	3. 32	2, 906	412	316	665	4, 299	146	2. 70

CALIFORNIA, IDAHO, NEVADA, AND OREGON

Total	7, 840	2, 222	260		10, 322	$37, 000	$3. 58	23	3	6	10	42	113	2. 17

COLORADO

Boulder	349, 375	107, 684	23, 067		480, 126	$1, 173, 000	$2. 44	366	75	49	72	562	211	4. 05
Delta	41, 443	32, 017	900		74, 360	213, 000	2. 86	62	7	3	19	91	132	6. 21
Dolores and San Miguel		11, 446	300		11, 746	32, 000	2. 72	9	1	1	1	12	259	3. 77
Elbert	675	2, 342			3, 017	6, 000	1. 99	7	1	1	1	10	171	1. 76
El Paso	120, 790	226, 441	11, 915		359, 146	941, 000	2. 62	211	24	50	40	325	231	4. 79
Fremont	462, 974	63, 959	4, 737		531, 670	1, 949, 000	3. 67	549	101	95	128	873	225	2. 71
Garfield	16, 264	28, 392	250		44, 906	119, 000	2. 65	36	3	4	4	47	235	4. 07
Gunnison	490, 280	6, 579	21, 927		518, 786	1, 267, 000	2. 44	382	103	64	108	657	159	4. 95
Huerfano	1, 732, 476	25, 253	14, 829		1, 772, 558	5, 653, 000	3. 19	1, 886	307	311	401	2, 905	163	3. 74
Jefferson	86, 150	6, 467	6, 209		98, 826	212, 000	2. 15	58	20	8	17	103	212	4. 53
La Plata	22, 496	39, 030		12, 595	74, 121	195, 000	2. 63	79	6	10	16	111	215	3. 11
Las Animas	2, 226, 494	49, 451	32, 416	235, 534	2, 543, 895	6, 318, 000	2. 48	2, 219	310	277	396	3, 202	203	3. 92
Mesa	77, 910	32, 306	2, 935		113, 151	255, 000	2. 25	116	12	15	14	157	201	3. 58
Moffat		5, 750	103		5, 853	13, 000	2. 22	9	2	1	1	13	185	2. 43
Montezuma	1, 100	4, 063			5, 163	25, 000	4. 84	6	1	1	1	9	218	2. 63
Rio Blanco		5, 977			5, 977	20, 000	3. 35	9	2	1	2	14	196	2. 18
Routt	955, 657	18, 034	32, 466		1, 006, 157	3, 359, 000	3. 34	751	75	183	250	1, 259	119	[1] 6. 71
Weld	2, 013, 268	154, 694	28, 296		2, 196, 258	4, 312, 000	1. 96	1, 168	165	136	130	1, 599	219	6. 28
Other counties (Jackson and Pitkin)	67, 465	4, 164	3, 396		75, 025	192, 000	2. 56	58	12	16	22	108	250	2. 78
	8, 664, 817	824, 049	183, 746	248, 129	9, 920, 741	26, 254, 000	2. 65	7, 981	1, 227	1, 226	1, 623	12, 057	187	4. 40

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[1] In this county certain mines have in recent times followed the practice of reducing their forces in periods of dull market and of working every day underground when the tipple works only 1, 2, or 3 days a week. As the figures of days worked represent tipple time, the result is not comparable with the returns for other counties; and the average for the State is affected also.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
GEORGIA														
Total	43, 921	458	257	----------	44, 636	$136, 000	$3. 05	----------	----------	----------	102	102	260	1. 68
ILLINOIS														
Bond and Clinton	642, 153	72, 578	30, 474	----------	745, 205	$1, 244, 000	$1. 67	521	107	88	100	816	155	5. 88
Bureau	250	7, 310	229	----------	7, 789	37, 000	4. 75	23	3	2	6	34	122	1. 89
Cass, Greene, Morgan, and Scott	----------	8, 195	----------	----------	8, 195	24, 000	2. 93	15	2	2	2	21	143	2. 73
Christian	3, 429, 754	171, 545	26, 384	----------	3, 627, 683	7, 037, 000	1. 94	2, 124	236	248	225	2, 833	166	7. 72
Edgar, Logan, and Macon	77, 191	190, 812	9, 640	----------	277, 643	782, 000	2. 82	402	52	65	53	572	191	2. 54
Franklin	14, 387, 458	101, 777	152, 110	----------	14. 641, 345	28, 568, 000	1. 95	7, 040	1, 722	1, 871	1, 290	11, 923	196	6. 25
Fulton	1, 485, 901	172, 146	54, 125	----------	1, 712, 172	2, 914, 000	1. 70	871	95	78	235	1, 279	189	7. 08
Gallatin	9, 348	11, 199	282	----------	20, 829	37, 000	1. 78	119	9	11	19	158	43	3. 04
Grundy	377, 109	31, 569	1, 764	----------	410, 442	941, 000	2. 29	240	48	63	34	385	262	4. 06
Hancock	----------	1, 504	----------	----------	1, 504	7, 000	4. 65	5	1	1	1	8	82	2. 30
Henry	36, 067	44, 888	1, 452	----------	82, 407	193, 000	2. 34	128	11	13	89	241	103	3. 31
Jackson	1, 526, 033	48, 860	625	----------	1, 575, 518	2, 260, 000	1. 43	287	81	85	359	812	161	[2] 12. 08
Jefferson and White	26, 606	4, 938	8, 546	----------	40, 090	72, 000	1. 80	105	16	13	22	156	75	3. 45
Knox	171, 233	39, 623	972	----------	211, 828	493, 000	2. 33	170	33	16	16	235	233	3. 87
La Salle	233, 458	312, 224	8, 092	----------	553, 774	1, 490, 000	2. 69	706	67	98	87	958	203	2. 84
Livingston	----------	19, 058	577	----------	19, 635	71, 000	3. 62	28	5	4	7	44	153	2. 92
McDonough	----------	4, 680	----------	----------	4, 680	19, 000	4. 06	13	1	1	1	16	206	1. 42
Macoupin	4, 858. 627	73, 334	117, 803	----------	5, 049, 764	8, 503, 000	1. 68	2, 366	365	574	282	3, 587	200	7. 04
Madison	2, 444, 462	210, 796	50, 133	----------	2, 705, 391	4, 700, 000	1. 74	1, 945	296	286	313	2, 840	169	5. 62
Marion	838, 674	43, 500	51, 222	----------	933, 396	1, 502, 000	1. 61	301	106	123	108	638	216	6. 76
Marshall	----------	5, 655	----------	----------	5, 655	19, 000	3. 36	12	2	2	1	17	140	2. 37
Menard	100	81, 616	2, 123	----------	83. 839	224, 000	2. 67	121	7	14	14	156	178	3. 03
Mercer	----------	27, 528	550	----------	28, 078	84, 000	2. 99	40	3	2	6	51	188	2. 93
Montgomery	1, 799, 398	32, 446	33, 543	----------	1, 865, 387	3, 060, 000	1. 64	809	153	199	120	1, 281	216	6. 73
Peoria	1, 261, 688	262, 269	7, 275	----------	1, 531, 232	3, 138, 000	2. 05	1, 140	155	146	112	1, 553	225	4. 38
Perry	2, 712, 911	172, 881	50, 674	----------	2, 936, 466	5, 374, 000	1. 83	1, 095	172	152	657	2, 076	158	8. 96

Randolph	498, 041	38, 577	18, 220	----------	554, 838	1, 046, 000	1. 89	717	106	82	70	975	93	6. 11
Rock Island	----------	17, 676	628	----------	18, 304	51, 000	2. 79	31	4	4	6	45	141	2. 89
St. Clair	2, 186, 128	556, 379	74, 776	----------	2, 817, 283	4, 435, 000	1. 57	2, 026	339	381	392	3, 138	148	6. 07
Saline	3, 993, 419	63, 031	65, 355	----------	4, 121, 805	8, 017, 000	1. 95	3, 053	698	361	508	4, 620	166	5. 36
Sangamon	3, 883, 804	384, 451	49, 120	----------	4, 317, 375	8, 265, 000	1. 91	3, 942	373	366	291	4, 972	176	4. 92
Schuyler	----------	21, 273	----------	----------	21, 273	48, 000	2. 26	44	3	3	2	52	222	1. 84
Shelby	4, 289	34, 067	4, 595	----------	42, 951	120, 000	2. 79	94	6	15	10	125	140	2. 45
Stark	----------	11, 046	----------	----------	11, 046	34, 000	3. 08	34	2	2	2	40	140	1. 97
Tazewell	349, 745	158, 680	1, 492	----------	509, 917	1, 052, 000	2. 06	411	41	38	51	541	217	4. 33
Vermilion	2, 677, 847	322, 993	37, 661	----------	3, 038, 501	5, 986, 000	1. 97	2, 055	282	511	364	3, 212	177	5. 33
Wabash	----------	5, 621	250	----------	5, 871	7, 000	1. 19	12	2	2	2	18	138	2. 36
Warren	----------	4, 410	----------	----------	4, 410	18, 000	4. 08	12	1	1	1	15	149	1. 98
Washington	30, 846	85, 068	4, 700	----------	120, 614	246, 000	2. 04	83	5	19	14	121	232	4. 29
Will and Woodford	717, 867	38, 238	5, 510	----------	761, 615	1, 603, 000	2. 10	181	13	17	187	398	213	8. 98
Williamson	5, 051, 965	96, 896	83, 030	----------	5, 231, 891	9, 732, 000	1. 86	3, 460	713	805	785	5, 763	140	6. 49
	55, 712, 372	3, 991, 337	953, 932	----------	60, 657, 641	113, 453, 000	1. 87	36, 781	6, 336	6, 764	6, 844	56, 725	177	6. 06

INDIANA

Clay	1, 017, 831	19, 407	36, 126	----------	1, 073, 364	$1, 766, 000	$1. 65	330	33	79	277	719	208	7. 18
Daviess	30, 747	18, 110	1, 801	----------	50, 658	67, 000	1. 32	64	9	8	11	92	133	4. 13
Gibson	1, 017, 601	56, 024	18, 350	----------	1, 091, 975	1, 672, 000	1. 53	297	102	81	128	608	196	9. 17
Greene	1, 396, 472	24, 941	26, 082	----------	1, 447, 495	2, 254, 000	1. 56	626	76	107	321	1, 130	144	8. 88
Knox	1, 389, 431	65, 592	18, 148	----------	1, 473, 171	2, 139, 000	1. 45	729	110	104	162	1, 105	151	8. 80
Owen	82, 969	397	5, 570	----------	88, 936	151, 000	1. 70	26	5	4	61	96	123	7. 54
Perry	----------	9, 515	----------	----------	9, 515	23, 000	2. 42	14	1	2	2	19	146	3. 44
Pike	2, 415, 932	36, 038	32, 400	----------	2, 484, 370	3, 281, 000	1. 32	384	53	44	748	1, 229	146	[2] 13. 82
Sullivan	2, 871, 482	33, 422	44, 710	----------	2, 949, 614	5, 445, 000	1. 85	1, 981	464	389	507	3, 341	165	5. 34
Vermillion	2, 151, 388	14, 173	25, 331	----------	2, 190, 892	3, 639, 000	1. 66	1, 396	220	173	273	2, 062	186	5. 71
Vigo	3, 680, 468	172, 632	102, 584	----------	3, 955, 684	7, 208, 000	1. 82	2, 186	364	444	345	3, 339	190	6. 23
Warrick	1, 199, 228	20, 913	6, 571	----------	1, 226, 712	1, 591, 000	1. 30	591	130	86	347	1, 154	163	6. 54
Other counties (Martin, Spencer, and Vanderburg)	134, 050	159, 360	8, 562	----------	301, 972	644, 000	2. 13	228	48	40	40	356	152	5. 58
	17, 387, 599	630, 524	326, 235	----------	18, 344, 358	29, 880, 000	1. 63	8, 852	1, 615	1, 561	3, 222	15, 250	172	7. 00

IOWA

Adams	----------	11, 332	1, 800	----------	13, 132	$40, 000	$3. 05	25	3	2	4	34	189	2. 04
Appanoose	492, 370	75, 584	1, 360	----------	569, 314	1, 542, 000	2. 71	1, 189	116	92	128	1, 525	151	2. 47
Boone	407, 395	72, 088	4, 107	----------	483, 590	1, 479, 000	3. 06	688	72	89	48	897	206	2. 61
Dallas	404, 498	13, 260	1, 638	----------	419, 396	1, 170, 000	2. 79	433	49	55	37	574	206	3. 55
Greene and Webster	----------	3, 777	----------	----------	3, 777	15, 000	3. 97	15	2	2	3	22	71	2. 42
Guthrie	----------	10, 609	----------	----------	10, 609	42, 000	3. 96	30	2	4	4	40	154	1. 72

[2] Much of the output of this county is obtained from strip pits, in which the production per man is large.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

IOWA—Continued

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
Jasper		54, 122	4, 505		58, 627	$165, 000	$2. 81	77	10	11	18	116	151	3. 36
Jefferson		3, 676			3, 676	9, 000	2. 45	10	1	1	1	13	158	1. 79
Lucas	425, 592	4, 543	9, 902		440, 037	1, 324, 000	3. 01	400	71	105	42	618	197	3. 61
Mahaska		48, 616	139		48, 755	126, 000	2. 58	120	4	6	9	139	148	2. 37
Marion	709, 563	54, 109	16, 995		780, 667	2, 255, 000	2. 89	694	97	124	53	968	229	3. 53
Monroe	483, 926	25, 926	3, 167		513, 019	1, 251, 000	2. 44	546	69	51	54	720	229	3. 11
Polk	269, 259	282, 075	9, 116		560, 450	1, 596, 000	2. 85	639	102	69	68	878	222	2. 87
Taylor	358	8, 470			8, 828	36, 000	4. 08	34	4	2	2	42	120	1. 75
Van Buren	3, 619	6, 103	75		9, 797	27, 000	2. 76	18	2	1	2	23	168	2. 53
Wapello	158	77, 021	235		77, 414	215, 000	2. 78	137	11	10	16	174	138	3. 22
Warren	184, 888	13, 594	4, 200		202, 682	519, 000	2. 56	270	29	56	35	390	219	2. 37
Wayne	2, 175	13, 095			15, 270	48, 000	3. 14	53	5	7	8	73	114	1. 83
Other counties (Davis, Keokuk, and Page)		22, 029			22, 029	89, 000	4. 04	30	6	6	7	49	133	3. 38
	3, 383, 801	800, 029	57, 239		4, 241, 069	11, 948, 000	2. 82	5, 408	655	693	539	7, 295	195	2. 98

KANSAS

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total	Average number of days worked	Average tons per man per day
Bourbon		28, 123	870		28, 993	$73, 000	$2. 52	10	2	2	50	64	198	2. 29
Cherokee	426, 949	81, 468	15, 194		523, 611	1, 013, 000	1. 93	347	21	16	208	592	143	6. 19
Crawford	2, 124, 932	104, 323	38, 440		2, 267, 695	5, 163, 000	2. 28	2, 586	251	144	610	3, 591	151	4. 17
Linn	6, 254	6, 810			13, 064	28, 000	2. 14	41	4	3	5	53	75	3. 27
Osage	42, 465	30, 023	60		72, 548	280, 000	3. 86	302	35	23	27	387	123	1. 52
Other counties (Leavenworth and Neosho)	35, 000	1, 060	34, 000		70, 060	140, 000	2. 00	352	20	30	50	452	284	. 55
	2, 635, 600	251, 807	88, 564		2, 975, 971	6, 697, 000	2. 25	3, 638	333	218	950	5, 139	160	3. 63

KENTUCKY

Eastern district:														
Bell	2, 853, 286	36, 453	17, 645	----------	2, 907, 384	$4, 600, 000	$1. 58	2, 252	440	374	479	3, 545	219	3. 74
Boyd	97, 675	1, 449	1, 470	----------	100, 594	151, 000	1. 50	73	10	17	21	121	251	3. 31
Breathitt	140. 652	62, 304	5, 700	----------	208, 656	294, 000	1. 41	173	44	26	38	281	226	3. 28
Clay	104, 341	14, 686	3, 508	----------	122, 535	196, 000	1. 60	152	41	34	43	270	137	3. 32
Floyd	4, 842, 474	33, 219	21, 247	----------	4, 896, 940	8, 133, 000	1. 66	2, 863	691	484	638	4, 676	239	4. 38
Harlan	13, 970, 031	93, 178	30, 244	----------	14, 093, 453	24, 432, 000	1. 73	6, 833	1, 564	1, 156	1, 278	10, 831	259	5. 02
Johnson	1, 202, 135	12, 123	7, 274	----------	1, 221, 532	2, 696, 000	2. 21	896	157	135	172	1, 360	228	3. 94
Knott	404, 017	4, 298	----------	----------	408, 315	608, 000	1. 49	213	72	39	76	400	183	5. 58
Knox	243, 275	11, 133	3, 666	----------	258, 074	351, 000	1. 36	237	62	26	65	390	192	3. 44
Laurel	83, 265	866	1, 165	----------	85, 296	140, 000	1. 64	164	21	42	18	245	145	2. 39
Letcher	6, 384, 544	49, 708	63, 733	----------	6, 497, 985	11, 002, 000	1. 69	3, 596	898	950	704	6, 148	245	4. 32
McCreary	1, 002, 338	7, 096	380	----------	1, 009, 814	1, 593, 000	1. 58	661	172	147	128	1, 108	242	3. 77
Martin	351, 640	1, 629	100	----------	353, 369	426, 000	1. 21	161	50	43	50	304	208	5. 60
Perry	5, 780, 531	41, 695	2, 135	----------	5, 824, 361	9, 124, 000	1. 57	3, 240	643	678	786	5, 347	229	4. 76
Pike	7, 292, 178	49, 706	30, 561	----------	7, 372, 445	11, 774, 000	1. 60	3, 628	895	820	982	6, 325	247	4. 73
Whitley	506, 665	5, 897	20, 385	----------	532, 947	1, 105, 000	2. 07	717	78	148	98	1, 041	198	2. 59
Other counties (Carter, Lee, Magoffin, Morgan, and Wayne)	83, 965	11, 363	36, 424	----------	131, 752	260, 000	1. 97	188	23	24	56	291	185	2. 44
	45, 343, 012	436, 803	245, 637	----------	46, 025, 452	76, 885, 000	1. 67	26, 047	5, 861	5, 143	5, 632	42, 683	239	4. 51
Western district:														
Daviess	16, 242	94, 466	1, 155	----------	111, 863	139, 000	1. 24	108	12	14	15	149	198	3. 80
Henderson	193, 087	69, 646	13, 346	----------	276, 079	371, 000	1. 34	302	64	36	43	445	150	4. 14
Hopkins	4, 297, 800	44, 622	13, 943	----------	4, 356, 365	5, 058, 000	1. 16	2, 790	412	647	789	4, 638	180	5. 22
Muhlenberg	4, 723, 682	80, 315	93, 770	----------	4, 897, 767	5, 529, 000	1. 13	3, 214	593	697	645	5, 149	173	5. 49
Ohio	911, 493	7, 400	9, 742	----------	928, 635	1, 040, 000	1. 12	966	175	53	166	1, 360	164	4. 17
Union	907, 952	87, 153	67, 287	----------	1, 062, 392	1, 153, 000	1. 09	716	131	237	157	1, 241	192	4. 46
Webster	2, 529, 683	39, 088	23, 844	----------	2, 592, 615	2, 884, 000	1. 11	1, 743	307	354	296	2, 700	183	5. 26
Other counties (Butler, Christian, Crittenden, and McLean)	202, 150	668	8, 614	----------	211, 432	224, 000	1. 06	204	31	22	27	284	201	3. 71
	13, 782, 089	423, 358	231, 701	----------	14, 437, 148	16, 398, 000	1. 14	10, 043	1, 725	2, 060	2, 138	15, 966	177	5. 10
Total, all Kentucky	59, 125, 101	860, 161	477, 338	----------	60, 462, 600	93, 283, 000	1. 54	36, 090	7, 586	7, 203	7, 770	58, 649	222	4. 64

MARYLAND

Allegany	1, 743, 055	101, 255	2, 749	----------	1, 847, 059	$3, 399, 000	$1. 84	1, 653	274	301	244	2, 472	249	3. 00
Garrett	775, 037	18, 574	8, 444	----------	802, 055	1, 241, 000	1. 55	517	121	61	118	817	236	4. 16
	2, 518, 092	119, 829	11, 193	----------	2, 649, 114	4, 640, 000	1. 75	2, 170	395	362	362	3, 289	246	3. 28

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

MICHIGAN

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
Bay, Midland, and Saginaw	744,517	10,725	49,627		804,869	$2,904,000	$3.61	899	164	154	119	1,336	217	2.77
MISSOURI														
Adair	121,542	25,013	5,012		151,567	$368,000	$2.43	201	29	24	35	289	202	2.60
Audrain		8,533	60		8,593	40,000	4.65	27	4	4	3	38	192	1.18
Barton	1,602,631	2,688	16,361		1,621,680	3,455,000	2.13	204	24	8	594	830	176	[3] 11.13
Bates	232,527	30,894	6,690		270,111	542,000	2.01	129	14	14	187	344	145	[3] 5.42
Boone		36,002	40		36,042	113,000	3.14	65	12	10	10	97	198	1.88
Caldwell and Platte	11,350	22,532	3,014		36,896	170,000	4.61	102	6	10	12	130	156	1.82
Callaway		34,667	12		34,679	126,000	3.63	61	6	7	29	103	199	1.69
Cedar and Jasper		6,434			6,434	19,000	2.95	2	1	1	6	10	194	3.31
Chariton and Ralls	14,833	5,025			19,858	65,000	3.27	45	3	5	4	57	174	2.01
Clay	55,850	18,908	336		75,094	234,000	3.12	140	29	44	14	227	213	1.55
Grundy, Harrison, and Schuyler	4,791	8,322			13,113	57,000	4.35	47	6	6	6	65	170	1.19
Henry	216,404	53,753	9,800		279,957	563,000	2.01	38	6	6	110	160	193	[3] 9.06
Johnson	33,090	8,423	993		42,506	112,000	2.63	67	4	2	5	78	234	2.32
Lafayette	371,640	63,011	8,504		443,155	1,197,000	2.70	640	62	125	68	895	213	2.32
Linn	10,191	23,849	350		34,390	127,000	3.69	90	7	5	10	112	146	2.11
Macon	176,517	35,634	5,356		217,507	557,000	2.56	322	26	27	36	411	176	3.01
Monroe		502			502	2,000	3.98	2	1	1	1	5	100	1.00
Putnam	9,489	15,932			25,421	70,000	2.75	77	11	5	11	104	139	1.75
Randolph	129,491	43,398	3,063		175,952	445,000	2.53	284	40	34	37	395	199	2.23
Ray	389,211	52,302	2,587		444,100	1,308,000	2.95	868	107	107	64	1,146	185	2.09
Vernon	88,109	2,395	2,250		92,754	208,000	2.24	22	4	2	94	122	114	6.69
	3,467,666	498,217	64,428		4,030,311	9,778,000	2.43	3,433	402	447	1,336	5,618	185	3.87

MONTANA

Blaine, Chouteau, Hill, Pondera, and Toole	300	15, 163			15, 463	$56, 000	$3. 62	48	5	4	6	63	126	1. 94
Carbon	691, 458	22, 250	34, 465		748, 173	2, 313, 000	3. 09	451	103	57	141	752	186	5. 36
Cascade	221, 627	21, 877	34		243, 538	630, 000	2. 59	198	35	11	27	271	181	4. 98
Daniels		3, 316			3, 316	7, 000	2. 11	5	2	1	2	10	120	2. 76
Dawson		5, 072			5, 072	11, 000	2. 17	8	1	1	1	11	139	3. 32
Fergus		4, 871			4, 871	10, 000	2. 05	7	1	1	1	10	161	3. 03
Judith Basin		4, 139			4, 139	17, 000	4. 11	6	2	1	1	10	209	1. 98
Musselshell	1, 073, 111	12, 771	11, 330		1, 097, 212	2, 511, 000	2. 29	537	145	120	126	928	178	6. 66
Richland and Wibaux	18, 707	19, 581			38, 288	118, 000	3. 08	22	6	3	7	38	210	4. 80
Roosevelt		5, 296			5, 296	13, 000	2. 45	10	1	1	2	14	115	3. 29
Rosebud	1, 216, 702	1, 553	1, 972		1, 220, 227	1, 830, 000	1. 50	2			136	138	343	[4] 25. 78
Sheridan		20, 547	30		20, 577	40, 000	1. 94	28	2	2	2	34	191	3. 17
Other counties (Custer and Golden Valley)		1, 354			1, 354	5, 000	3. 69	4				4	92	3. 68
	3, 221, 905	137, 790	47, 831		3, 407, 526	7, 561, 000	2. 22	1, 326	303	202	452	2, 283	189	7. 90

NEW MEXICO

Colfax	1, 423, 027	12, 608	16, 225		1, 451, 860	$4, 453, 000	$3. 07	927	119	182	200	1, 428	192	5. 29
McKinley	881, 531	24, 645	27, 291		933, 467	2, 890, 000	3. 10	779	151	89	145	1, 164	228	3. 51
Rio Arriba	24, 253	60	349		24, 662	66, 000	2. 68	21	5	3	8	37	232	2. 87
San Juan	475	6, 158			6, 633	17, 000	2. 56	8	2	2	2	14	148	3. 19
Other counties (Lincoln, Sandoval, Santa Fe, and Socorro)	185, 685	7, 757	12, 705		206, 147	888, 000	4. 31	372	73	18	127	590	240	1. 46
	2, 514, 971	51, 228	56, 570		2, 622, 769	8, 314, 000	3. 17	2, 107	350	294	482	3, 233	214	3. 79

NORTH CAROLINA

Total	46, 280	3, 200	2, 700		52, 180	$177, 000	$3. 39	120	10	10	20	160	260	1. 25

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[3] The output of this county is chiefly obtained from strip pits, in which the production per man per day is large. The tipple of 1 of the Barton County mines is in Kansas, but the coal is accredited to Missouri.

[4] The output of this county is obtained from strip pits, in which the production per man per day is large. As much development work was done in 1929, the tonnage per man per day was less than in 1928.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

NORTH DAKOTA (LIGNITE)

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
Adams	30, 618	18, 811	1, 202		50, 631	$94, 000	$1. 86	45	5	2	10	62	155	5. 26
Billings and Golden Valley	1, 800	3, 539			5, 339	11, 000	2. 06	8	1	1	1	11	114	4. 26
Bowman	17, 235	16, 199	5, 650		39, 084	67, 000	1. 71	28	3	3	14	48	178	4. 58
Burke and Divide	317, 943	11, 707			329, 650	584, 000	1. 77	16	5	3	80	104	206	[5] 15. 42
Burleigh	207, 932	18, 165	2, 197		228, 294	383, 000	1. 68	135	17	12	39	203	172	6. 52
Dunn		4, 268			4, 268	9, 000	2. 11	8	1	1	1	11	178	2. 18
Grant	4, 433	16, 735	200		21, 368	42, 000	1. 97	26	4	4	9	43	176	2. 82
Hettinger	5, 445	17, 881			23, 326	39, 000	1. 67	22	3	3	15	43	153	3. 54
McKenzie		2, 944			2, 944	5, 000	1. 70	6	1	1	1	9	128	2. 56
McLean	69, 189	32, 090	3, 500		104, 779	212, 000	2. 02	40	5	3	86	134	156	5. 00
Mercer	450, 783	37, 971	6, 049		494, 803	775, 000	1. 57	208	24	17	85	334	190	7. 79
Morton	13, 152	29, 043			42, 195	77, 000	1. 82	36	4	4	10	54	232	3. 37
Mountrail		4, 266			4, 266	11, 000	2. 58	9	2	2	2	15	160	1. 78
Oliver		3, 309			3, 309	5, 000	1. 51				6	6	202	2. 73
Stark	14, 400	74, 274	19, 304		107, 978	178, 000	1. 65	48	10	9	51	118	268	3. 42
Ward	295, 554	37, 575	400		333, 529	536, 000	1. 61	63	2	3	65	133	203	[5] 12. 34
Williams	14, 504	51, 863			66, 367	129, 000	1. 94	74	5	6	8	93	215	3. 32
	1, 442, 988	380, 640	38, 502		1, 862, 130	3, 157, 000	1. 70	772	92	74	483	1, 421	192	6. 84

OHIO

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total	Average number of days worked	Average tons per man per day
Athens	2, 617, 766	48, 861	13, 971		2, 680, 598	$4, 015, 000	$1. 50	3, 107	311	442	420	4, 280	166	3. 77
Belmont	6, 802, 424	375, 570	31, 670		7, 209, 664	10, 157, 000	1. 41	4, 854	569	617	561	6, 601	222	4. 91
Carroll	278, 933	110, 277	234		389, 444	543, 000	1. 39	357	56	30	50	493	212	3. 73
Columbiana	180, 524	64, 747	617		245, 888	447, 000	1. 82	291	36	20	37	384	196	3. 27
Coshocton	113, 405	46, 498	769		160, 672	284, 000	1. 77	182	23	12	20	237	179	3. 78
Guernsey	1, 527, 966	163, 547	9, 785		1, 701, 298	2, 570, 000	1. 51	1, 082	212	141	118	1, 553	222	4. 94
Harrison	2, 718, 259	16, 587	39, 499		2, 774, 345	3, 682, 000	1. 33	608	167	112	694	1, 581	229	7. 66
Hocking	628, 178	79, 875	1, 148		709, 201	1, 022, 000	1. 44	757	88	52	117	1, 014	167	4. 19

Holmes	----------	25,342	6	----------	25,348	62,000	2.45	37	3	3	3	46	197	2.80
Jackson	58,460	81,968	5,368	----------	145,796	282,000	1.93	224	27	21	33	305	168	2.85
Jefferson	3,018,169	605,383	16,039	----------	3,639,591	5,833,000	1.60	2,429	480	201	565	3,675	211	4.69
Lawrence	----------	113,110	2,199	----------	115,309	243,000	2.11	126	11	20	12	169	235	2.91
Mahoning	----------	69,215	250	----------	69,465	194,000	2.79	117	7	5	17	146	191	2.49
Medina, Summit, and Wayne	----------	11,715	300	----------	12,015	42,000	3.50	26	3	5	4	38	110	2.86
Meigs	602,184	31,244	----------	----------	633,428	955,000	1.51	584	85	75	70	814	196	3.96
Morgan, Scioto, and Washington	260,680	1,388	----------	----------	262,068	404,000	1.54	241	30	45	19	335	244	3.21
Muskingum	136,876	71,817	416	----------	209,109	354,000	1.69	281	21	29	22	353	177	3.35
Noble	579,142	8,930	10,750	----------	598,822	894,000	1.49	364	69	70	37	540	194	5.72
Perry	483,830	61,465	700	----------	545,995	790,000	1.45	585	64	67	153	869	135	4.67
Portage	----------	8,589	900	----------	9,489	30,000	3.16	13	4	2	4	23	160	2.58
Stark	111,949	248,128	3,030	----------	363,107	884,000	2.43	367	62	25	70	524	229	3.03
Tuscarawas	684,634	442,293	1,311	----------	1,128,238	1,963,000	1.74	984	112	93	132	1,321	196	4.37
Vinton	37,472	22,166	949	----------	60,587	83,000	1.37	73	12	6	7	98	152	4.07
	20,840,851	2,708,715	139,911	----------	23,689,477	35,733,000	1.51	17,689	2,452	2,093	3,165	25,399	201	4.64

OKLAHOMA

Coal	128,847	4,029	1,452	----------	134,328	$423,000	$3.15	124	12	13	16	165	239	3.40
Craig	----------	3,569	50	----------	3,619	10,000	2.76	8	1	1	1	11	159	2.07
Haskell	149,852	10,360	1,200	----------	161,412	411,000	2.55	95	23	11	88	217	163	4.55
Latimer	200,243	4,395	6,142	----------	210,780	661,000	3.14	338	62	43	54	497	158	2.68
LeFlore	634,880	34,339	3,530	----------	672,749	1,819,000	2.70	874	151	147	159	1,331	149	3.39
Mayes and Rogers	41,647	2,093	2,045	----------	45,785	99,000	2.16	----------	----------	----------	52	52	146	6.02
Muskogee and Wagoner	214,059	1,000	271	----------	215,330	485,000	2.25	----------	----------	----------	163	163	185	7.13
Okmulgee	767,383	2,636	2,800	----------	772,819	1,901,000	2.46	850	145	91	95	1,181	181	3.61
Pittsburg	1,283,814	10,684	25,174	----------	1,319,672	5,015,000	3.80	1,504	292	297	249	2,342	197	2.86
Tulsa	181,186	52,725	3,675	----------	237,586	657,000	2.77	151	17	13	181	362	161	4.09
	3,601,911	125,830	46,339	----------	3,774,080	11,481,000	3.04	3,944	703	616	1,058	6,321	178	3.36

PENNSYLVANIA (BITUMINOUS)

Allegheny	14,366,313	2,189,559	77,869	----------	16,633,741	$28,067,000	$1.69	9,383	1,438	1,464	1,422	13,707	249	4.87
Armstrong	4,318,021	145,949	4,064	----------	4,468,034	7,010,000	1.57	3,316	377	383	567	4,643	204	4.71
Beaver	33,471	118,402	108	----------	151,981	345,000	2.27	169	21	10	62	262	207	2.80
Bedford	365,789	201,970	2,173	----------	569,932	1,152,0 00	2.02	656	104	55	82	897	172	3.69
Blair and Fulton	262,997	84,214	8,805	30,629	386,645	798,000	2.06	459	53	39	53	604	229	2.80
Bradford and Lycoming	12,036	1,967	----------	----------	14,003	34,000	2.43	51	2	5	12	70	129	1.55
Butler	1,234,425	135,310	3,250	----------	1,372,985	2,391,000	1.74	1,465	207	119	216	2,007	192	3.56
Cambria	14,441,083	2,776,741	126,010	171,097	17,514,931	35,721,000	2.04	12,848	1,624	1,382	1,851	17,705	221	4.48
Center	750,322	68,020	489	----------	818,831	1,419,000	1.73	1,008	97	77	112	1,294	186	3.40
Clarion	1,372,483	99,730	564	----------	1,472,777	2,424,000	1.65	1,360	151	99	170	1,780	239	3.47
Clearfield	3,764,944	156,622	21,979	----------	3,943,545	7,067,000	1.79	4,898	432	368	616	6,314	173	3.61

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[5] The output is obtained chiefly from strip pits, in which the production per man per day is large.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

PENNSYLVANIA (BITUMINOUS)—Continued

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground			Surface	Total		
								Miners, loaders, and shot firers	Haulage and track	All others				
Clinton	154,391	24,656	4,871		183,918	$312,000	$1.70	195	29	9	102	335	131	4.18
Elk	991,431	7,413	13,459		1,012,303	1,734,000	1.71	1,049	89	92	124	1,354	211	3.54
Fayette	25,558,355	280,758	315,562	5,245,553	31,400,228	59,087,000	1.88	12,301	3,186	4,707	3,233	23,427	258	5.20
Greene	6,225,491	36,971	39,311		6,301,773	10,692,000	1.70	2,346	626	758	654	4,384	267	5.38
Huntingdon	506,862	8,584	13,673		529,119	1,167,000	2.21	718	85	59	116	978	205	2.64
Indiana	7,552,902	261,876	24,546	378,546	8,217,870	14,774,000	1.80	6,092	636	699	1,017	8,444	198	4.93
Jefferson	2,521,806	38,814	14,172		2,574,792	4,183,000	1.62	2,026	183	260	306	2,775	222	4.17
Lawrence	167,317	16,741	13,362		197,420	538,000	2.73	202	36	31	49	318	236	2.63
McKean and Venango	2,226	6,498			8,724	23,000	2.64	9	2	2	4	17	210	2.44
Mercer	211,164	25,628	10,908		247,700	624,000	2.52	217	38	36	55	346	256	2.80
Somerset	8,573,540	145,895	97,306		8,816,741	15,590,000	1.77	5,993	876	753	1,080	8,702	229	4.43
Tioga	95,513	63,944	4,510		163,967	479,000	2.92	323	29	17	52	421	123	3.16
Washington	18,718,235	455,542	78,579	75,331	19,327,687	33,017,000	1.71	11,495	1,815	1,686	1,710	16,706	242	4.77
Westmoreland	14,863,415	696,449	220,160	1,406,570	17,136,594	29,959,000	1.74	9,126	1,641	1,453	2,064	14,284	232	5.20
	127,064,532	8,048,253	1,095,730	7,307,726	143,516,241	258,607,000	1.80	87,705	13,777	14,563	15,729	131,774	230	4.73

SOUTH DAKOTA (LIGNITE)

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total	Average number of days worked	Average tons per man per day
Corson, Dewey, and Ziebach	200	4,516			4,716	$13,000	$2.76	11				11	103	4.15
Harding and Meade		2,243			2,243	9,000	4.01	9				9	125	1.99
Perkins		5,895			5,895	16,000	2.71	12				12	149	3.29
	200	12,654			12,854	38,000	2.96	32				32	127	3.17

TENNESSEE

Anderson	943, 695	11, 107	906		955, 708	$1, 525, 000	$1. 60	735	148	112	147	1, 142	234	3. 57
Campbell	1, 008, 054	8, 999	9, 381		1, 026, 434	1, 780, 000	1. 73	1, 032	191	112	238	1, 573	213	3. 07
Claiborne	950, 414	5, 535			955, 949	1, 617, 000	1. 69	683	163	108	126	1, 080	215	4. 11
Fentress	386, 481	3. 712	8, 666		398, 859	548, 000	1. 37	302	56	49	107	514	205	3. 79
Grundy	407, 495	2, 863	3, 851	39, 738	453, 947	814, 000	1. 79	497	37	16	140	690	257	2. 56
Hamilton	131, 252	4, 867	1, 601		137, 720	319, 000	2. 32	172	46	32	51	301	195	2. 35
Marion	216, 167	6, 371	546		223, 084	406, 000	1. 82	298	26	25	56	405	179	3. 07
Morgan	315, 672	6, 366	9, 017	33, 994	365, 049	562. 000	1. 54	445	78	181	73	777	262	1. 79
Scott	19, 625	3, 150	497		23, 272	45, 000	1. 93	53	3	4	4	64	222	1. 64
Other counties (Cumberland, Overton, Putnam, Rhea, Roane, Sequatchie, and White)	722, 544	10, 062	20, 536	112, 300	865, 442	1, 506, 000	1. 74	663	161	116	133	1, 073	255	3. 17
	5, 101, 399	63, 032	55, 001	186, 032	5, 405, 464	9, 122, 000	1. 69	4, 880	909	755	1, 075	7, 619	228	3. 11

TEXAS

Bituminous: Palo Pinto, Webb, and Wise	103, 864	2. 814	2, 928		109. 606	$436. 000	$3. 98	360	51	32	91	534	222	0. 92
Lignite:														
Anderson and Henderson	376, 792	4, 251	455		381, 498	646, 000	1. 69	170	37	43	18	268	245	5. 82
Bastrop, Bexar, and Lee	81, 322		3. 120		84, 442	79, 000	. 94	117	17	10	15	159	172	3. 08
Milam	349, 647	1	4, 734		354, 382	235, 000	. 66	70	6	8	51	135	253	[5] 10. 39
Houston and Leon	52, 872		1, 800		54, 672	71, 000	1. 28	105	3	4	8	120	123	3. 71
Titus and Wood	110, 868	4, 000	1. 200		116, 068	133, 000	1. 15	63	14	8	12	97	189	6. 32
Total lignite	971, 501	8. 252	11, 309		991. 062	1, 164, 000	1. 17	525	77	73	104	779	206	6. 19
State total	1, 075, 365	11, 066	14, 237		1, 100, 668	1, 600, 000	1. 45	885	128	105	195	1, 313	212	3. 95

UTAH

Carbon	4, 493, 140	23, 912	14, 918	23, 361	4, 555, 331	$11, 203, 000	$2. 46	1, 792	409	276	520	2, 997	210	7. 25
Emery	429, 074	9, 065	410		438, 549	1, 115, 000	2. 54	181	35	21	45	282	201	7. 73
Summit	46, 177	5, 925	1, 260		53, 362	115, 000	2. 16	33	12	5	11	61	229	3. 83
Uintah		5, 770	90		5, 860	24, 000	4. 19	9	2	2	3	16	237	1. 55
Other counties (Grand, Iron, and San Pete)	104, 136	3, 283			107, 419	268, 000	2. 49	61	9	19	13	102	251	4. 19
	5, 072, 527	47, 955	16, 678	23, 361	5, 160, 521	12, 725, 000	2. 47	2, 076	467	323	592	3, 458	211	[6] 7. 09

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[5] The output is obtained chiefly from strip pits, in which the production per man per day is large.

[6] The calculated output per man per day is affected by the practice of men going into certain mines to shoot and load coal on days when the tipples and mines as a whole are not in operation.

TABLE 87.—*Production, value, men employed, days worked, and output per man per day at bituminous-coal mines in specified States and counties in 1929*—Continued

County	Net tons					Value		Number of employees					Average number of days worked	Average tons per man per day
								Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
VIRGINIA														
Dickenson	799, 807	7, 435	1, 420	----------	808, 662	$1, 119, 000	$1. 38	460	118	90	139	807	221	4. 53
Lee	2, 121, 562	17, 888	3, 625	----------	2, 143, 075	3, 614, 000	1. 69	1, 273	276	204	320	2, 073	251	4. 12
Montgomery	146, 479	4, 645	587	----------	151, 711	409, 000	2. 70	194	24	45	72	335	167	2. 71
Russell	1, 395, 381	13, 678	5, 618	----------	1, 414, 677	1, 977, 000	1. 40	737	221	118	212	1, 288	220	4. 99
Tazewell	2, 798, 728	8, 314	2, 034	----------	2, 809, 076	4, 928. 000	1. 75	1, 303	329	352	382	2, 366	274	4. 33
Wise	4, 744, 348	38, 270	23, 940	495, 158	5, 301, 716	8, 620, 000	1. 63	2, 451	716	1, 138	652	4, 957	256	4. 18
Other counties (Pulaski and Scott)	113, 407	1, 962	4, 020	----------	119, 389	275, 000	2. 30	91	30	35	71	227	213	2. 47
	12, 119, 712	92, 192	41, 244	495, 158	12, 748, 306	20, 942, 000	1. 64	6, 509	1, 714	1, 982	1, 848	12, 053	249	4. 24
WASHINGTON														
King	484, 790	73, 398	1, 828	----------	560, 016	$2, 059, 000	$3. 68	427	96	120	135	778	243	2. 96
Kittitas	1, 047, 794	22, 861	18, 854	----------	1, 089, 509	3, 718, 000	3. 41	843	115	62	146	1, 166	209	4. 46
Lewis	50, 632	26, 906	1, 863	----------	79, 401	207, 000	2. 60	96	14	8	23	141	146	3. 85
Pierce	258, 657	4, 393	1, 621	34, 894	299, 565	1, 281, 000	4. 28	192	59	127	79	457	277	2. 37
Other counties (Thurston and Whatcom)	457, 746	25, 914	9, 176	----------	492, 836	1, 382, 000	2. 80	252	49	29	74	404	221	5. 53
	2, 299, 619	153, 472	33, 342	34, 894	2. 521, 327	8, 647, 000	3. 43	1, 810	333	346	457	2, 946	227	3. 77
WEST VIRGINIA														
Barbour	2, 402, 974	21, 777	2, 643	----------	2, 427, 394	$2, 938, 000	$1. 21	1, 351	256	175	183	1, 965	199	6. 22
Boone	3, 484, 006	19, 781	4, 933	----------	3, 508, 720	5, 440, 000	1. 55	1, 630	412	381	358	2, 781	251	5. 02
Braxton	83, 864	42, 533	4, 249	----------	130, 646	187, 000	1. 43	158	31	11	43	243	150	3. 59
Brooke	1, 102, 234	802, 463	----------	----------	1, 904, 697	3, 206, 000	1. 68	1, 018	193	95	190	1, 496	238	5. 34
Clay	804, 549	23, 777	11, 605	----------	839, 931	1, 288, 000	1. 53	452	128	72	117	769	245	4. 45

Fayette	12,300,989	124,073	43,300	649,109	13,117,471	23,846,000	1.82	7,012	1,873	1,436	1,632	11,953	251	4.37
Gilmer and Lewis	48,412	12,592	2,951		63,955	75,000	1.17	55	17	11	14	97	198	3.33
Greenbrier	1,897,389	13,306	2,037		1,912,732	3,100,000	1.62	869	305	216	184	1,574	245	4.97
Hancock		18,013	33		18,046	46,000	2.55	30	2	2	2	36	209	2.40
Harrison	5,840,693	276,425	1,319		6,118,437	7,721,000	1.26	2,991	606	538	534	4,669	199	6.58
Kanawha	6,944,124	65,108	16,216		7,025,448	10,329,000	1.47	3,912	855	623	670	6,060	223	5.19
Lincoln	6,862		600		7,462	8,000	1.07	23	4	5	4	36	67	3.08
Logan	19,689,032	93,058	24,995		19,807,085	27,133,000	1.37	5,951	1,671	1,636	1,701	10,959	261	6.92
McDowell	25,012,098	264,005	138,141	6,671	25,420,915	43,797,000	1.72	8,638	3,042	3,535	3,605	18,820	260	5.19
Marion	9,101,375	109,149	43,534		9,254,058	13,736,000	1.48	3,736	742	1,042	672	6,192	234	6.40
Marshall	1,596,963	341,453	12,990		1,951,406	3,008,000	1.54	1,324	162	216	183	1,885	233	4.44
Mason	14,117	37,992	1,925		54,034	92,000	1.70	52	9	7	8	76	187	3.81
Mercer	4,092,667	28,639	7,047	22,595	4,150,948	7,018,000	1.69	1,875	643	323	811	3,652	277	4.10
Mineral	267,394	10,936	272		278,602	468,000	1.68	380	36	39	54	509	183	2.99
Mingo	6,019,476	40,424	3,517		6,063,417	8,391,000	1.38	2,023	798	768	701	4.290	265	5.32
Monongalia	8,222,728	143,530	100		8,366,358	9,488,000	1.13	3,319	734	605	631	5,289	240	6.60
Nicholas	110,043	3,803	5,328		119,174	273,000	2.29	124	28	6	21	179	221	3.01
Ohio	2,256,250	198,541	5,697		2,460,488	3,500,000	1.42	1,549	186	239	181	2,155	244	4.68
Preston	1,757,828	12,877	12,010	152,806	1,935,521	3,106,000	1.60	1,343	261	189	215	2,008	213	4.52
Putnam	436,283	7,827			444,110	783,000	1.76	340	59	78	77	554	235	3.41
Raleigh	15,640,295	126,926	63,289		15,830,510	27,722,000	1.75	6,176	2,137	1,387	1,811	11,511	270	5.09
Randolph	406,355	15,374	5,643		427,372	570,000	1.33	328	78	37	57	500	173	4.95
Taylor	823,637	20,512	10		844,159	999,000	1.18	620	115	50	75	860	198	4.97
Tucker	985,960	8,207	50,977	2,126	1,047,270	1,882,000	1.80	614	160	104	98	976	259	4.14
Upshur	349,896	10,731	6,425		367,052	412,000	1.12	245	42	34	59	380	173	5.58
Webster	134,880	39,145	1,917		175,942	340,000	1.93	170	45	34	48	297	227	2.61
Wyoming	2,147,689	12,808	13,128		2,173,625	3,830,000	1.76	825	317	351	347	1,840	245	4.83
Other counties (Grant and Wayne)	260,569	1,045	10,256		271,870	378,000	1.39	191	37	33	70	331	226	3.64
	134,241,631	2,946,830	497,087	833,307	138,518,855	215,110,000	1.55	59,324	15,984	14,278	15,356	104,942	247	5.34

WYOMING

Big Horn and Park		3,217			3,217	$13,000	$4.04	6	1	1	1	9	259	1.38
Campbell and Johnson	60,322	20,320	7,257		87,899	109,000	1.24	15	1	2	28	46	151	[7] 12.64
Carbon	508,249	7,320	16,430		531,999	1,364,000	2.56	121	26	52	25	224	220	[7] 10.78
Converse		1,064	10		1,074	3,000	2.79	4				4	121	5.02
Hot Springs	458,371	9,384	37,535		505,290	1,766,000	3.50	346	89	71	71	577	201	4.36
Lincoln	968,830	9,025	51,877		1,029,732	2,731,000	2.65	592	85	72	154	903	247	4.61
Sheridan	726,106	42,439	2,152		770,697	1,530,000	1.99	203	78	13	85	379	153	[7] 13.26
Sweetwater	3,574,159	28,782	64,411		3,667,352	9,281,000	2.53	1,592	339	292	376	2,599	246	5.75
Other counties (Fremont and Uinta)	89,578	10,027	7,925		107,530	255,000	2.37	69	10	5	14	98	190	5.77
	6,385,615	131,578	187,597		6,704,790	17,052,000	2.54	2,948	629	508	754	4,839	230	6.02

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[7] The large output per man is explained by the use of power shovel or loading machine.

COAL PRODUCED AND CONSUMED IN ALASKA

TABLE 88.—*Coal produced and consumed in Alaska, 1920–1929*

Year	Produced in Alaska, chiefly subbituminous and lignite [1]		Imported from States, chiefly bituminous coal from Washington [2] (net tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia [2] (net tons)	Total coal consumed (net tons)
	Net tons	Value			
1920	61,111	$355,668	38,128	45,264	144,503
1921	76,817	496,394	24,278	33,776	134,871
1922	79,275	430,639	28,457	34,251	141,983
1923	119,826	755,469	34,082	43,205	197,113
1924	99,663	559,980	40,161	41,980	181,804
1925	82,868	404,617	37,324	57,230	177,422
1926	87,300	459,000	35,620	34,254	157,174
1927	104,300	548,000	[3] 39,437	30,492	[3] 174,229
1928	126,100	662,000	[3] 39,408	[3] 32,518	[3] 198,026
1929	100,610	528,000	36,693	27,073	164,376

[1] Compiled by the Alaska branch of the United States Geological Survey.
[2] Compiled from records of the Bureau of Foreign and Domestic Commerce.
[3] Revised figures.

DETAILED STATISTICS OF ANTHRACITE AND SEMIANTHRACITE OUTSIDE OF PENNSYLVANIA

Need of separate figures.—Tables 89 to 91 analyze the production of anthracite and semianthracite from fields outside of Pennsylvania. As already pointed out (p. 693) these coals have no direct connection with the close-knit Pennsylvania anthracite industry. For statistical purposes they are generally included with the bituminous-coal industry, and they are so included in the primary tables of this report. The producers of these coals, however, are building up a specialized trade of their own. Their product differs from bituminous coal and is especially adapted to household use. It has become an important element in the domestic fuel supply of many communities, and its rapid growth has been an interesting feature of the domestic market since the war. To serve those interested in this development a special study of the supply and distribution of hard coal from mines outside of Pennsylvania was published in Coal in 1928, to which the reader is referred.[18] Statistics for 1929 are given in the following tables.

Coals included.—No attempt is made here to set up or lend authority to a particular system of classifying coals. Such procedure would be especially inappropriate at present, because the task of classifying coals is lengthy and difficult, and because the entire subject is now being considered by a sectional committee on classification of coal, under the sponsorship of the American Society for Testing Materials and the rules of the American Standards Association. Pending the final decision of the committee, the classification in most general use is that adopted by the United States Geological Survey, and the coals here included are those defined by the survey as anthracite and semianthracite. According to the survey, anthracite is defined as "hard coal having a fuel ratio (fixed carbon divided by the volatile matter) of not more than 50 or 60 and not less than 10," while the fuel ratio for semianthracite (with some modifications) ranges from 6 to 10. Aside from the mines of eastern Pennsylvania, such coals are commercially produced in the Crested Butte field of Colorado, the Los Cerrillos field of New Mexico, the Spadra and Russellville districts of Arkansas,[19] and that portion of the Valley coal fields of Virginia lying in Montgomery and Pulaski Counties.[20] Some of these coals have been classified by the Geological Survey as anthracite and some as semianthracite. In this connection it should be noted that the term semianthracite, though sanctioned by long usage, is unfortunate, because many persons might understand it to imply a product resembling bituminous coal and necessarily inferior to anthracite. Observers are agreed that semianthracite as defined by the Geological Survey differs sharply from bituminous coal and closely resembles anthracite. Furthermore, the slightly higher volatile content (or slightly lower fuel ratio), characteristic of semianthracite, does not necessarily impair the market value of a coal. On the contrary, the Lykens Valley coals of Pennsylvania, which have a volatile content from 2 to 5 per cent higher than most Pennsylvania anthracites, have long been recognized in the trade as commanding a premium over and above the price obtained for the usual Pennsylvania anthracite.

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[18] Tryon, F.G., Kiessling, O. E., and Mann, L., Coal: Bureau of Mines Mineral Resources of the United States, 1928, Part II, pp. 557-569. See also Kiessling, O. E., Hard Coals Outside of Pennsylvania Make Consistent Gains: Coal Age, January, 1930, pp. 29-32.

On the commercial market the coals in question are known by characteristic trade names. Thus, the Virginia coal is sold as "Great Valley (or Virginia) anthracite," the Spadra and Russellville coals as "Arkansas anthracite," and the hard coals from Colorado and New Mexico as "Colorado anthracite," and "New Mexico (or Cerrillos) anthracite," respectively. For convenience, the group as a whole is referred to in this report as "hard coal outside of Pennsylvania," to distinguish it from the product of the Pennsylvania anthracite industry.

Trend of production and prices.—The production of hard coal outside of Pennsylvania has been increasing rapidly. In 1929 the output was 842,000 tons, as against 363,000 in 1913. A peak was reached in 1926, caused by the shortage of domestic fuel brought on by the great strike of the anthracite miners. In 1929, with Pennsylvania anthracite in abundant supply, the production outside of Pennsylvania came within a few hundred tons of equaling the maximum of the strike year.

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[19] Campbell, M. R., and others, The Coal Fields of the United States: U. S. Geol. Survey Prof. Paper 100-A, 1922, pp. 27-28, 30.

[20] Campbell, M. R., and others, The Valley Coal Fields of Virginia: Virginia Geol. Survey Bull. 25. prepared in cooperation with the U. S. Geol. Survey, Charlottesville, Va., 1925, pp. 115, 126.

TABLE 89.—*Production and average value per ton of hard coal mined outside of Pennsylvania, 1913–1929*

Year	Production (net tons)			Average value per ton		
	Virginia	Arkansas, Colorado, and New Mexico	Total	Virginia	Arkansas, Colorado, and New Mexico	Total
1913	54, 579	308, 745	363, 324	$1. 54	$2. 76	$2. 58
1914	45, 151	300, 927	346, 078	1. 98	2. 50	2. 43
1915	51, 141	325, 255	376, 396	2. 16	2. 95	2. 84
1916	109, 543	415, 699	525, 242	1. 69	2. 78	2. 55
1917	127, 836	446, 337	574, 173	2. 71	3. 73	3. 50
1918	127, 448	441, 556	569, 004	3. 21	5. 13	4. 70
1919	105, 753	372, 258	478, 011	3. 11	5. 42	4. 91
1920	163, 728	424, 403	588, 131	3. 88	6. 06	5. 45
1921	85, 161	[1] 329, 184	[1] 414, 345	4. 08	5. 75	5. 40
1922	114, 111	208, 314	322, 425	4. 49	6. 44	5. 75
1923	213, 659	412, 021	625, 680	4. 82	5. 61	5. 34
1924	186, 084	518, 429	704, 513	3. 68	5. 06	4. 70
1925	266, 657	519, 937	786, 594	3. 75	4. 75	4. 41
1926	263, 823	579, 302	843, 125	4. 07	4. 80	4. 57
1927	158, 828	493, 041	651, 869	2. 83	4. 99	4. 46
1928	171, 896	540, 510	712, 406	2. 78	4. 64	4. 19
1929	268, 955	573, 358	842, 313	2. 53	4. 45	3. 84

[1] Includes a small tonnage of bituminous coal from a different seam for 1 mine in Colorado.

This record of growth is especially significant when it is compared with other branches of the coal industry that have either lost volume or barely remained stationary since 1913. To make comparisons easier the figures of production are reduced to index numbers in Table 90, taking the year 1913 as 100. It will be seen that the output of Pennsylvania anthracite was 19 per cent less in 1929 than in 1913 and that in the same period the production of bituminous coal in-

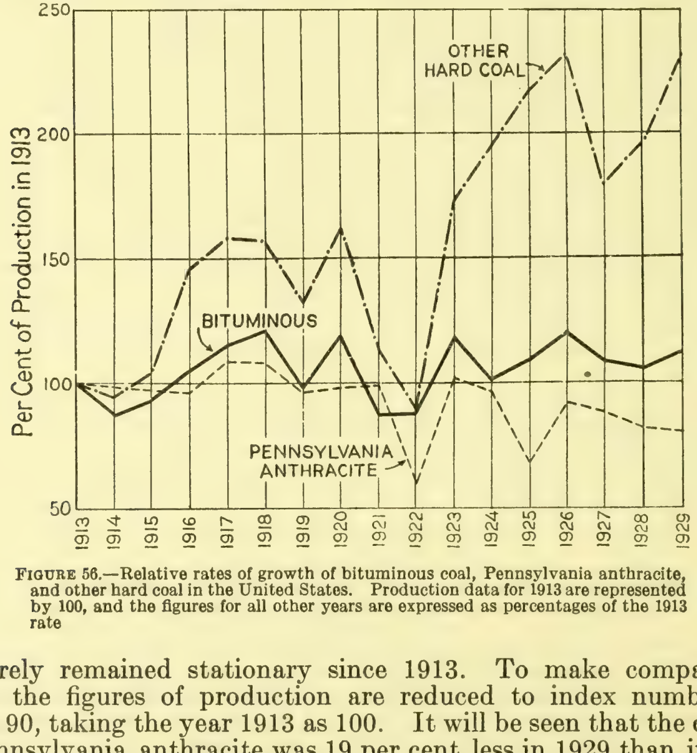

FIGURE 56.—Relative rates of growth of bituminous coal, Pennsylvania anthracite, and other hard coal in the United States. Production data for 1913 are represented by 100, and the figures for all other years are expressed as percentages of the 1913 rate

creased only 12 per cent. The production of hard coal outside of Pennsylvania, on the other hand, increased 132 per cent. In only two years, 1914 and 1922, has production fallen below the 1913 level, and in both years the disturbing factor was labor difficulties. As shown in Figure 56 bituminous coal has little more than held its own, Pennsylvania anthracite has fallen off, and all other hard coal has greatly improved its position.

The relative advance of the hard coals outside of Pennsylvania is partly due to the fact that they have been declining in price since 1922, whereas prices of the domestic sizes of Pennsylvania anthracite have shown little change. (See Table 89; also Coal in 1928, p. 561.)

TABLE 90.—*Relative rates of growth of bituminous coal, Pennsylvania anthracite, and all other hard coal, 1913–1929*

[The figures for the year 1913 are represented by the number 100, and the figures for all other years are expressed as percentages of the 1913 rate]

Year	Bituminous coal	Pennsylvania anthracite	All other anthracite and semianthracite
1913	100	100	100
1914	88	99	95
1915	93	97	104
1916	105	96	145
1917	115	109	158
1918	121	108	157
1919	97	96	132
1920	119	98	162
1921	87	99	114
1922	88	60	89
1923	118	102	172
1924	101	96	194
1925	109	68	217
1926	120	92	232
1927	108	88	179
1928	105	82	196
1929	112	81	232

Details of operations in 1929.—Details of operations are shown in Table 91. The mines in this group now employ over 2,000 men, and the value of the product in 1929 was $3,233,000. The average number of days worked in 1929 was 168. The average output per man per day was 2.12 tons. The average value per ton, which amounted to $3.84, is, of course, affected by the low prices obtained for screenings. Prices of the domestic sizes range substantially higher.

TABLE 91.—*Production, value, men employed, days worked, and output per man per day at the principal hard-coal mines outside of Pennsylvania, 1926–1929*

State	Net tons				Value		Number of employees					Average number of days worked	Average tons per man per day
							Underground						
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for power and heat	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	Haulage and track	All others	Surface	Total		
1926													
Virginia	244, 507	13, 822	5, 494	263, 823	$1, 072, 556	$4. 07	198	30	55	121	404	256	2. 55
Arkansas, Colorado, and New Mexico	555, 261	10, 954	13, 087	579, 302	2, 778, 892	4. 80	880	96	222	405	1, 603	148	2. 44
	799, 768	24, 776	18, 581	843, 125	3, 851, 448	4. 57	1, 078	126	277	526	2, 007	170	2. 47
1927													
Virginia	145, 474	9, 579	3, 775	158, 828	449, 059	2. 83	246	48	33	100	427	132	2. 82
Arkansas, Colorado, and New Mexico	479, 912	4, 665	8, 464	493, 041	2, 459, 616	4. 99	916	136	275	328	1, 655	129	2. 31
	625, 386	14, 244	12, 239	651, 869	2, 908, 675	4. 46	1, 162	184	308	428	2, 082	130	2. 41
1928													
Virginia	160, 558	7, 724	3, 614	171, 896	477, 187	2. 78	356	49	33	112	550	128	2. 45
Arkansas, Colorado, and New Mexico	522, 490	5, 749	12, 271	540, 510	2, 506, 791	4. 64	1, 175	170	205	353	1, 903	129	2. 20
	683, 048	13, 473	15, 885	712, 406	2, 983, 978	4. 19	1, 531	219	238	465	2, 453	129	2. 26
1929													
Virginia	258, 151	6, 197	4, 607	268, 955	681, 000	2. 53	281	53	78	142	554	187	2. 60
Arkansas, Colorado, and New Mexico	557, 471	6, 972	8, 915	573, 358	2, 552, 000	4. 45	1, 177	157	118	336	1, 818	162	1. 95
	815, 622	13, 169	13, 522	842, 313	3, 233, 000	3. 84	1, 458	210	226	478	2, 372	168	2. 12

Distribution.—Like Pennsylvania anthracite, the hard coals of other States stand transportation well and are sold over wide areas. Colorado anthracite, as shown in Figure 57, was shipped to 16 States in 1929, moving as far north as Washington and Montana, as far east as Minnesota and Missouri, as far south as Texas, and as far west as Nevada. Similar figures for Arkansas anthracite are given in Coal in 1928, page 566. Hard coal from one or the other of the two fields is used in practically every State west of the Mississippi and in four States east of that river.

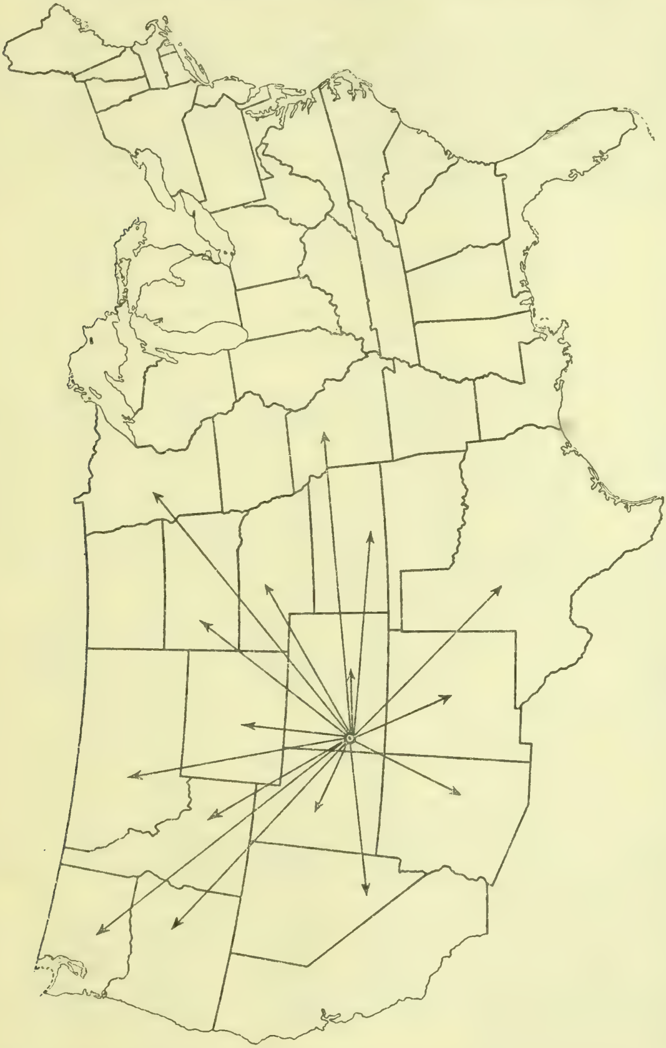

FIGURE 57.—Distribution of Colorado anthracite in 1929. The broad market for this coal is indicated by the arrows, which show shipments into 17 States

DETAILED STATISTICS OF PENNSYLVANIA ANTHRACITE

STATISTICAL SUMMARY

The salient developments in the anthracite industry during the past decade are summarized in Table 1A. The course of the industry is traced through the varying conditions of the past 10 years, including the bituminous coal shortage of 1920, the strike of 1922 (the effects of which were apparent far into 1923), the great strike of 1925–26, and the subsequent readjustments in recent years. These changing conditions are reflected in the statistical record of production, consumption, and distribution; of sales realization and sizes shipped; and of men employed, time worked, and time lost through strikes.

TABLE 1A.—*Salient statistics of the Pennsylvania anthracite industry, 1920–1929*

	1920	1921	1922	1923	1924
Production:					
Loaded at mines for shipment—					
Breakers……gross tons	63, 598, 683	67, 981, 416	37, 906, 503	69, 288, 426	67, 592, 270
Washeries……do	4, 615, 514	1, 308, 436	2, 600, 481	3, 754, 287	1, 060, 354
Dredges……do	396, 566	264, 711	566, 854	384, 999	318, 357
Sold to local trade and used by employees……gross tons	2, 586, 163	2, 511, 206	2, 123, 393	2, 900, 314	2, 717, 803
Used at mines for power and heat……gross tons	8, 801, 511	8, 714, 098	5, 626, 896	7, 010, 375	6, 817, 343
Total……do	79, 998, 437	80, 779, 867	48, 824, 127	83, 338, 401	78, 506, 127
Value at breaker, washery, or dredge	$434, 252, 000	$452, 305, 000	$273, 700, 000	$506, 787, 000	$477, 231, 000
Average sales realization per gross ton on breaker shipments:					
Stove	$7. 51	$7. 67	$8. 03	$8. 56	$8. 74
Pea	$5. 70	$5. 74	$5. 92	$6. 18	$5. 60
Total domestic	$7. 23	$7. 39	$7. 77	$8. 23	$8. 25
Buckwheat No. 1	$3. 76	$3. 43	$3. 56	$3. 48	$2. 94
Buckwheat No. 2	$2. 69	$2. 27	$2. 37	$2. 23	$1. 93
Total steam	$3. 22	$2. 75	$2. 77	$2. 64	$2. 25
All sizes	$6. 16	$6. 27	$6. 48	$6. 77	$6. 70
Percentage by sizes in total breaker shipments:					
Broken……per cent	5. 2	3. 7	4. 3	5. 0	2. 7
Egg……do	15. 6	15. 0	14. 5	15. 7	14. 5
Stove……do	19. 3	21. 5	21. 5	19. 6	22. 2
Chestnut……do	26. 3	27. 2	25. 8	25. 6	26. 5
Pea……do	7. 9	8. 4	7. 8	8. 0	8. 3
Steam sizes……do	25. 7	24. 2	26. 1	26. 1	25. 8
Exports……gross tons	4, 825, 000	4, 176, 000	2, 366, 000	4, 545, 000	3, 587, 000
Imports……do	28, 000	8, 000	209, 000	268, 000	105, 000
Consumption (calculated)……do	76, 595, 000	73, 170, 000	50, 713, 000	77, 602, 000	72, 069, 000
Average number of days worked	271	271	151	268	274
Man-days lost on account of strikes and lockouts	1, 815, 316	823, 279	19, 623, 026	2, 629, 418	1, 143, 630
Number of men on strike during year	96, 840	52, 117	142, 442	135, 585	71, 273
Average number of men employed	145, 074	159, 499	156, 849	157, 743	160, 009
Output per man per day……gross tons	2. 04	1. 87	2. 06	1. 97	1. 79
Output per man per year……do	552	506	312	529	491
Quantity cut by machines……do	837, 565	874, 237	448, 922	1, 079, 055	1, 271, 325
Quantity produced by stripping……do	1, 834, 322	1, 810, 527	847, 987	2, 020, 623	1, 665, 783
Distribution:					
Total receipts in New England [1]……net tons	11, 255, 000	11, 374, 000	6, 471, 000	12, 185, 000	10, 611, 000
Exports to Canada……do	4, 968, 282	4, 519, 216	2, 572, 450	4, 988, 837	3, 927, 999
Loaded into vessels at Lake Erie [2]……net tons	4, 032, 989	4, 265, 714	1, 381, 946	3, 512, 079	3, 094, 088
Receipts at Duluth-Superior [3]……net tons	1, 637, 477	1, 844, 642	566, 362	1, 419, 984	1, 289, 994

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[1] From records of the Massachusetts Special Commission on the Necessaries of Life.

[2] From records of the Ore and Coal Exchange.

[3] From records of the United States Engineer Office, Duluth, Minn.

TABLE 1A.—*Salient statistics of the Pennsylvania anthracite industry, 1920–1929*—Continued

	1925	1926		1927	1928	1929
Production:						
Loaded at mines for shipment—						
Breakers ---------- gross tons	46, 615, 423	65, 826, 189		61, 129, 944	57, 635, 506	57, 324, 911
Washeries ---------- do	872, 276	1, 067, 810		1, 317, 623	1, 245, 192	684, 186
Dredges ---------- do	519, 776	354, 947		494, 653	483, 231	289, 634
Sold to local trade and used by employees ---------- gross tons	2, 575, 515	2, 399, 474		2, 720, 330	2, 843, 594	2, 886, 628
Used at mines for power and heat ---------- gross tons	4, 610, 893	5, 742, 162		5, 851, 346	5, 067, 539	4, 732, 672
Total ---------- do	55, 193, 883	75, 390, 582		71, 513, 896	67, 275, 062	65, 918, 031
Value at breaker, washery, or dredge	$327, 665, 000	$474, 164, 000		$420, 942, 000	$393, 638, 000	$385, 643, 000
		Old method[4]	New method[4]			
Average sales realization per gross ton on breaker shipments:						
Stove	$8. 79	$9. 09	$9. 14	$8. 86	$8. 72	$8. 72
Pea	$5. 27	$5. 98	$5. 98	$5. 90	$5. 00	$4. 66
Total domestic	$8. 30	$8. 60	$8. 66	$8. 33	$8. 09	$8. 00
Buckwheat No. 1	$2. 49	$2. 39	$2. 52	[5] $2. 56	[5] $2. 75	[5] $2. 63
Buckwheat No. 2	$1. 84	$1. 78	$1. 78	$1. 78	$1. 85	$1. 77
Total steam	$2. 00	$1. 88	$1. 94	$1. 98	$2. 12	$2. 04
All sizes	$6. 59	$6. 78	$6. 84	$6. 50	$6. 38	$6. 30
Percentage by sizes in total breaker shipments:						
Broken ---------- per cent	2. 6	1. 6		1. 0	0. 7	0. 6
Egg ---------- do	13. 5	13. 5		11. 7	11. 7	11. 4
Stove ---------- do	24. 4	25. 1		25. 9	25. 6	25. 8
Chestnut ---------- do	26. 8	27. 1		26. 4	25. 4	25. 6
Pea ---------- do	5. 6	5. 5		6. 2	7. 8	8. 1
Steam sizes ---------- do	27. 1	27. 2		28. 8	28. 8	28. 5
Exports ---------- gross tons	2, 838, 000	3, 598, 000		2, 969, 000	2, 979, 000	3, 041, 000
Imports ---------- do	342, 000	727, 000		106, 000	343, 000	435, 000
Consumption (calculated) ---------- do	57, 197, 000	68, 947, 000		66, 671, 000	65, 759, 000	63, 801, 000
Average number of days worked	182	244		225	217	225
Man-days lost on account of strikes and lockouts	15, 269, 506	5, 990, 477		159, 242	400, 682	272, 511
Number of men on strike during year	147, 928	145, 376		20, 478	36, 128	39, 777
Average number of men employed	160, 312	165, 386		165, 259	160, 681	151, 501
Output per man per day ---------- gross tons	1. 89	1. 87		1. 92	1. 93	1. 93
Output per man per year ---------- do	345	456		433	419	435
Quantity cut by machines ---------- do	840, 347	831, 183		1, 046, 329	1, 151, 615	1, 035, 634
Quantity produced by stripping ---------- do	1, 409, 355	2, 144, 068		1, 922, 461	2, 163, 325	1, 706, 934
Distribution:						
Total receipts in New England[1] ---------- net tons	8, 280, 000	10, 608, 000		9, 145, 000	9, 376, 000	9, 039, 000
Exports to Canada ---------- do	3, 096, 815	3, 941, 718		3, 238, 564	3, 296, 487	3, 376, 303
Loaded into vessels at Lake Erie[2] ---------- net tons	1, 793, 516	2, 857, 917		1, 918, 389	1, 420, 882	1, 321, 328
Receipts at Duluth-Superior[3] ---------- net tons	790, 132	1, 272, 973		981, 194	652, 095	401, 249

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[1] From records of the Massachusetts Special Commission on the Necessaries of Life.

[2] From records of the Ore and Coal Exchange.

[3] From records of the United States Engineer Office, Duluth, Minn.

[4] The figures under the heading "Old method" are computed so as to be exactly comparable with the earlier years. Those under the heading "New method" are based on a more accurate system of estimating the values of one company which reported quantities but not values and (except for buckwheat No. 1) are strictly comparable with the figures for 1927, 1928, and 1929. (See Coal in 1926, p. 576, and Coal in 1927, pp. 502–503.)

[5] The averages for buckwheat No. 1 in 1927–1929 were computed according to the "Old method" and are comparable with the figure of $2.39 in 1926 and with those given for 1918 to 1925. (See Coal in 1927, pp. 502–503.)

THE ANTHRACITE SITUATION

Changes in market conditions, principally since 1923, have greatly altered the demand for domestic fuels. For the past five years the market for hard coal has been contracting, and the major efforts of the anthracite industry have been directed toward the retention of its competitive position.

Growth in the use of fuels in place of anthracite.—A partial explanation of the reduced anthracite output is found in the increased use of competitive fuels in place of hard coal. Such quantitative material as is available indicates that important competitors of domestic anthracite in househeating are fuel oil, by-product coke, manufactured gas, fuel briquets, imported anthracite, and raw bituminous coal. In view of the analyses given on this general topic in preceding reports (see p. 573, Coal in 1928; and pp. 477–481, Coal in 1927), it will suffice to indicate briefly that the use of most of the competitive fuels in 1929 was greater than in the preceding years.

According to E. B. Swanson, of the Bureau of Mines, the total consumption of oil for domestic heating in 1929 amounted to 17,640,556 barrels, a gain of 23.6 per cent over 1928 and a growth of 530 per cent over 1924. In addition to this amount, 17,692,851 barrels were used for commercial heating (apartment houses, hotels, schools, and hospitals). The amount of by-product coke used for househeating in 1929 was 7,376,320 tons, as compared with 6,254,382 tons in 1928 and 1,408,000 tons in 1918. The American Gas Association reported that the quantity of manufactured gas sold for househeating increased from 17.8 billion cubic feet in 1928 to 23.1 billion cubic feet in 1929, a gain of 29.8 per cent. Although a relatively small item, the production of 1,212,415 tons of fuel briquets in 1929 represents a gain of 28 per cent over the preceding year; also, over the same period, the tonnage of briquets imported increased 25 per cent. The total imports of anthracite in 1929 amounted to 487,172 tons, a gain of 26.6 per cent over 1928 and the largest amount imported for any year in the past decade with the exception of the strike period of 1926.

Accurate figures are lacking on the quantity of bituminous coal used for househeating in 1929, except for Massachusetts, where, according to the State Commission on the Necessaries of Life, the consumption of bituminous coal for heating homes was 495,000 tons in 1928–29 and 500,000 tons in 1929–30.

Such data as are available on the shipments of anthracite and on the trend of consumption of competitive fuels have been assembled in Table 2A. It will be noted that while the anthracite industry regained a large majority of its customers after the strike of 1925–26, the decline in hard-coal shipments and the figures on sales of competitive fuels indicate losses of trade that have not yet been recovered.

TABLE 2A.—*Commercial production of Pennsylvania anthracite and total supplies of other fuels used for domestic purposes in the United States, 1926–1929*

[The figures for 1926 were affected by the great strike of the anthracite miners which lasted from Sept. 1, 1925, to Feb. 18, 1926]

	1926	1927	1928	1929
Solid fuels (net tons)				
Pennsylvania anthracite production:				
Shipments of domestic sizes	54, 096, 437	48, 999, 058	46, 218, 403	46, 141, 575
Shipments of buckwheat No. 1 [1]	8, 581, 966	9, 062, 977	8, 769, 923	8, 597, 053
Shipments of smaller steam sizes	12, 640, 417	12, 433, 251	11, 499, 274	10, 555, 951
Local sales	2, 687, 411	3, 046, 770	3, 184, 825	3, 233, 023
Total commercial production	78, 006, 231	73, 542, 056	69, 672, 425	68, 527, 602
Anthracite exported	4, 029, 683	3, 325, 507	3, 336, 272	3, 406, 369
Anthracite imported, chiefly from United Kingdom	813, 956	119, 030	384, 707	487, 172
Fuel briquets produced	995, 332	970, 468	947, 423	1, 212, 415
Fuel briquets imported	123, 593	60, 601	71, 485	89, 458
By-product coke sold for domestic use	5, 056, 568	4, 702, 529	6, 254, 382	7, 376, 320
Beehive coke sold for domestic use	386, 045	111, 103	78, 338	134, 703
Coke imported	284, 548	168, 859	147, 701	119, 724
Gas-house coke sold [2]	1, 400, 000	1, 484, 268	1, 450, 000	1, 400, 000
Petroleum coke produced [3]	995, 300	1, 145, 200	1, 426, 600	1, 820, 600
Anthracite and semianthracite produced outside of Pennsylvania	843, 125	651, 869	712, 406	842, 313
Bituminous coal for domestic use [4]	(5)	(5)	(5)	(5)
Oil (barrels)				
Oil used for heating houses [6]	9, 080, 000	11, 709, 000	[7] 14, 271, 556	17, 640, 556
Oil used for heating offices, hotels, apartments, schools, hospitals, and buildings other than houses [6]	13, 874, 000	15, 751, 000	[7] 16, 427, 105	17, 692, 851
Gas (million cubic feet)				
Natural gas consumed for domestic use	289, 175	296, 036	320, 877	359, 853
Manufactured gas sold for domestic purposes	(8)	[9] 281, 044	(8)	(8)

[1] A considerable part of the buckwheat No. 1 is used for domestic purposes.

[2] Figures for 1928 and 1929 are subject to revision.

[3] How much petroleum coke was used for house fuel prior to 1928 is not known. For that year 235,000 tons was reported to have been consumed for domestic heating, according to E. B. Swanson, in Economic Paper No. 9, Bureau of Mines.

[4] During the anthracite strike about 17,000,000 tons of bituminous coal in addition to the normal consumption was used to replace anthracite.

[5] Between 56,000,000 and 77,000,000 tons a year.

[6] Based on surveys by E. B. Swanson, U. S. Bureau of Mines.

[7] Revised since last report.

[8] No data.

[9] From Census of Manufactures.

Decline in retail prices.—Reference has already been made to the decline in the mine price of anthracite during the past few years. (See p. 824 and Table 1A.) To what extent the producer's competitive position has been strengthened by reductions in wholesale prices depends upon the degree to which these reductions affect the prices paid by the consumer. Prices of coal to consumers include freight charges to points of consumption plus wholesalers' and retailers' margins, amounting to almost as much again as the price of the coal at the breaker. Hence, a cut in the mine price is ordinarily reflected by a much smaller relative reduction in the retail price.

Table 3A is based on figures collected by the Bureau of Labor Statistics and shows the average retail prices of stove anthracite and bituminous coal in representative cities from 1924 to 1929. It will be noted that there has been an unmistakable downward trend in the retail price of anthracite during the last few years. In general, the decline continued in 1929, especially in Baltimore and New York.

TABLE 3A.—*Average retail prices of stove anthracite and of bituminous coal in representative cities, by months, 1925–1929, as reported by the Bureau of Labor Statistics*

[From Monthly Labor Review. All figures in net tons of 2,000 pounds except as noted. Prices represent sidewalk delivery. Grades of bituminous coal were not specified]

Month	Anthracite, white-ash stove				Bituminous coal		
	Baltimore [1]	Boston	New York	Chicago	Chicago	Detroit	Norfolk
1925							
January	$16.25	$16.00	$14.33	$16.74	$8.51	$8.93	$9.27
February	16.25	16.00	14.42	16.74	8.50	8.96	9.27
March	16.25	16.00	14.42	16.70	8.48	8.83	9.27
April	15.50	15.75	14.00	16.70	8.41	8.77	9.27
May	15.50	15.75	14.02	16.10	8.06	8.70	8.57
June	15.75	15.75	14.12	16.30	8.23	8.70	8.52
July	15.75	16.00	14.22	16.30	8.21	8.79	8.48
August	16.00	16.00	14.37	16.36	8.32	8.89	8.52
September	16.00	16.25	15.13	16.77	8.89	9.73	9.05
October	16.21	16.25	17.04	17.19	8.99	9.86	9.05
November	(2)	17.00	20.50	18.13	9.65	10.59	10.43
December	(2)	17.80	(2)	18.13	9.49	10.70	10.52
1926							
January	(2)	(2)	(2)	(2)	9.48	10.59	10.52
February	(2)	(2)	(2)	(2)	9.34	10.53	10.52
March	16.75	18.00	15.71	16.89	8.99	10.69	10.16
April	16.00	16.00	14.75	16.86	8.39	10.45	9.34
May	16.00	16.00	14.75	16.84	8.12	9.33	8.46
June	16.00	16.00	14.75	16.84	8.13	9.24	8.41
July	16.00	16.25	14.75	16.88	8.27	9.30	8.52
August	16.00	16.25	14.75	16.88	8.32	9.25	8.52
September	16.00	16.25	14.75	16.90	8.91	9.90	9.09
October	16.08	16.40	14.75	16.91	9.06	10.39	9.66
November	16.00	16.50	14.75	17.00	10.15	11.61	10.39
December	16.00	16.50	14.75	17.00	10.34	11.05	10.25
1927							
January	16.00	16.50	14.75	17.00	9.85	10.34	9.68
February	16.00	16.50	14.75	17.00	9.64	10.22	9.73
March	16.00	16.50	14.54	17.00	9.31	9.78	9.71
April	15.25	15.75	13.75	16.25	8.89	9.57	8.27
May	15.25	15.75	13.83	16.25	8.98	9.41	8.27
June	15.50	15.75	14.08	16.50	9.12	9.28	8.57
July	15.75	16.00	14.08	16.70	9.09	9.18	8.55
August	15.75	16.00	14.08	16.70	9.16	9.21	8.55
September	16.00	16.00	14.38	16.95	9.32	9.38	8.80
October	16.00	16.25	14.38	16.94	9.30	9.38	9.07
November	16.00	16.25	14.75	16.95	9.29	9.35	9.07
December	16.00	16.25	14.75	16.95	9.17	9.31	9.07
1928							
January	16.00	16.25	14.75	16.95	9.21	9.31	9.05
February	16.00	16.25	14.75	16.95	9.21	9.31	9.09
March	16.00	16.25	14.75	16.95	9.21	9.33	9.05
April	15.17	15.50	14.25	16.95	9.20	9.23	9.05
May	15.00	15.50	14.25	16.00	8.18	9.15	8.55
June	15.25	15.50	14.46	16.25	8.30	8.99	8.55
July	15.25	15.50	14.50	16.25	8.35	9.13	8.55
August	15.25	15.75	14.50	16.25	8.58	9.13	8.55
September	15.75	15.75	14.71	16.50	8.72	8.98	8.50
October	16.00	16.00	14.75	16.75	9.15	9.05	8.55
November	16.00	16.25	14.75	16.90	9.15	9.19	9.07
December	16.00	16.25	14.79	16.90	9.10	9.31	9.07
1929							
January	16.00	16.25	14.79	16.80	8.20	8.33	7.88
February	16.00	16.25	14.75	16.90	8.20	8.30	7.88
March	16.00	16.25	14.79	16.90	8.20	8.27	7.81
April	16.00	16.25	13.83	16.85	8.27	8.30	7.81
May	13.50	15.25	13.83	16.40	7.61	8.30	7.88
June	13.50	15.25	14.08	16.41	7.62	8.31	7.81
July	14.00	15.80	14.13	16.55	7.74	8.23	7.81
August	14.00	15.85	14.25	16.65	7.88	8.31	7.81
September	14.25	15.95	14.33	16.63	8.22	8.39	7.81
October	14.25	16.00	14.54	16.85	8.42	8.46	7.38
November	14.25	16.00	14.54	16.85	8.45	8.39	7.25
December	14.25	16.00	14.58	16.85	8.47	8.39	7.25

[1] Per gross ton.

[2] Insufficient data.

ANTHRACITE'S EFFORTS TO MEET COMPETITION

With fuels other than anthracite making inroads into many of the principal hard-coal markets, the producers in the anthracite region are making a vigorous and united effort to rehabilitate the industry. That the industry is faced with severe competition is now fully recognized, and the operators are eagerly adopting methods that promise the retention and recovery of markets. The attack of the operators has been directed along the lines of improved preparation practice, intensive group and individual sales and promotion efforts, greater cooperation with retail dealers, extensive educational programs, and the cultivation of better public relations.

The Anthracite Operators' Conference is leading the attempt to solve the industry's merchandising problems. This organization represents both the larger companies and the independent producers, and its activities have been instrumental in establishing a better understanding between producer and retailer.

Anthracite Coal Service.—The formation of the Anthracite Coal Service represents one of the constructive steps taken by the Anthracite Operators' Conference. The former is an organization of heating and combustion engineers maintained to assure consumers satisfaction in the use of anthracite, to stimulate sales by cooperating with the retailers, and to maintain contact with architects and engineers throughout the anthracite-consuming territory. The headquarters of the Anthracite Coal Service are maintained in Philadelphia and division offices are located in New York City, Boston, Albany, Syracuse, Detroit, Chicago, Milwaukee, Minneapolis, St. Paul, and Montreal (Canada). Besides these division offices there are representatives of the Anthracite Coal Service located in a number of other important cities in the anthracite-marketing area.

Anthracite Coal Service engineers work directly with consumers of hard coal, demonstrating the proper methods of firing under varying conditions and explaining how economies can be effected. These engineers also maintain combustion schools where employees of the retail dealers receive instruction in the fundamentals of combustion engineering, plant inspection, and servicing the consumer. From the time the training classes were begun to the close of 1929, 2,799 employees of 1,793 retail dealers in 111 cities have been instructed. In cities where the training course has been completed or is well advanced, cooperative newspaper advertising, paid for jointly by the anthracite producers and by the local dealers, is available to retailers.

The Anthracite Coal Service also publishes a monthly pamphlet entitled "The Anthracite Salesman," about 14,000 copies of which are distributed, principally to dealers. This publication features sales and service aids and contains suggestions for improving business. Envelope stuffers and leaflets outlining methods for obtaining the best results from the use of anthracite for househeating are distributed free of charge to retail coal merchants.

Improved preparation practice and inspection service.—Considerable attention has also been given by the Anthracite Operators' Conference to fostering improvements in the preparation of anthracite in order that the consumer's favor may be held with carefully screened and properly sized coal. Effort is made to see that each individual operator adheres strictly to the new standard specifications adopted in 1928.

For the last two years the conference has carried on an inspection service under the supervision of the director of the Anthracite Bureau of Information. To assure the consumer that the product from each colliery measures up to certain prescribed specifications, a staff of qualified inspectors has been engaged. Each colliery is inspected as frequently as twice a month, without advance notice to colliery superintendents. These inspections complement the efforts of the inspectors regularly employed by the colliery.

Partly as a result of the improved inspection service, it is claimed that a higher quality and better sized anthracite is now being marketed than ever before in the history of the industry.

Research in the use of anthracite.—Early in 1929 the services of the Frost research laboratory were engaged by the hard-coal producers for testing and developing devices for the more economical and efficient use of anthracite. R. V. Frost, head of the laboratory, made the following statement: "The prime purpose of the research carried on here at Norristown is to widen the consumption of anthracite. People are now concerned with convenience and comfort rather than increased labor, and on this fact is based our investigations."

During the year the work conducted at the laboratory was chiefly on the testing and development of automatic stokers, heat-control devices, and ash-disposal systems. Other work undertaken included combustion tests to determine accurately the relative efficiency of anthracite, coke, and other fuels. Since the beginning of the investigations, almost every form of stoker which is designed for the use of anthracite or which might conceivably be adapted to that purpose has been tested.[21] Research was also conducted on a new type of feed boiler, and the laboratory assisted a number of inventors and manufacturers who were attempting to improve anthracite burning equipment. A close relation was maintained between the laboratory and manufacturers, engineers, and members of scientific and other associations interested in domestic heating problems.

One of the accomplishments of the year was the development of a new stoker. This plant is automatic and requires no attention except the removal of ashes. Much effort was also devoted to the development of ash-handling systems in connection with different types of domestic heating plants.

Anthracite Institute.—Recently, considerable attention has been given to the public's attitude toward the industry. To act as intermediary between producers and the public the Anthracite Institute has been organized. This agency proposes "to keep the public informed of all developments of interest in the industry, to effect a barrier of protection against unfair practices prejudicial to public interest", and "to promote the best interests of the anthracite industry and all engaged therein through the maintenance of strict standards of sizing and preparation of anthracite." The Anthracite Institute is also responsible for coordinating many of the collective activities of industry.

Other recent developments.—Other innovations designed to assist the industry in the solution of its problems include the establishment of a credit bureau and traffic department and the organization of the

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[21] Coal Age, Anthracite Experiments with Research: January, 1930, pp. 12–13.

Anthracite Equipment Corporation. The credit bureau was established in 1929 and is said to have been useful in stabilizing credits, facilitating collections, and otherwise aiding sales departments.

The functions of the traffic department are described by E. W. Parker, director, Anthracite Bureau of Information, as follows:

> The traffic department, organized the latter part of 1928, is in close contact with the anthracite originating railroads and maintains a file of tariffs covering existing rates to anthracite consuming territory. Tariffs on bituminous coal and coke to competing territory are also on file. New tariffs are checked promptly as tariffs are filed with the Interstate Commerce Commission. Reports of examiners in anthracite cases and decisions of the Interstate Commerce Commission and the Public Service Commission of Pennsylvania are analyzed. Data desired by members have been compiled and furnished as requested. During the year friendly negotiations were conducted with the traffic executives of the anthracite railroads in an effort to secure an adjustment of rates to western points in the United States and to points in Canada * * *. The traffic department is prepared to furnish information pertaining to rates, transportation, and other traffic matters of interest to the anthracite industry.

Another important step recently taken by the Anthracite Operators Conference has been the organization of the Anthracite Equipment Corporation. The object of this organization is to encourage the invention and technical progress of completely automatic anthracite burning equipment. It is the hope of those in the industry that, with the development of improved equipment, new markets will be opened to anthracite.

Modernization programs of individual companies.—A review of the efforts being made by the industry to retain and recover markets would be incomplete without reference to the extensive modernization programs that have been undertaken by many of the large producing companies. The capacity of the mechanical cleaning facilities under construction at anthracite operations in 1929 totaled almost 8,200 tons per hour.[22]

During the year attention was attracted to the program of the Philadelphia & Reading Coal & Iron Co., which began work on two new breakers, one at Locust Summit and the other at Gilbertson. Both of these plants are to be equipped with Chance cones having an aggregate capacity of 3,440 tons per hour. At about the same time the Hudson Coal Co. undertook the installation of equipment capable of handling 1,200 tons per hour and the construction of a completely new washery at Middletown, N. Y., for preparing coal in storage. Other companies active in the construction of new preparation plants were the Glen Alden Coal Co., the Lehigh Valley Coal Corporation, the Jeddo-Highland Coal Co., the Lehigh Coal & Navigation Co., and the Hazel Brook Coal Co.

PRODUCTION, BY WEEKS AND MONTHS

The following tables summarize the statistics of the weekly and monthly production of anthracite that are first published in the Bureau of Mines weekly coal reports. Statistics of weekly output of anthracite are estimated from the records of cars of anthracite loaded by the nine railroads that serve the region. The weekly figures, expressed in net tons to facilitate comparisons, have been adjusted to the annual total ascertained by direct canvass of the operators themselves.

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[22] Coal Age, New Topworks Construction Active in 1929: January, 1930, pp. 48–49.

The working year in the anthracite region is somewhat less than the average for the bituminous-coal industry. The region is completely unionized, and the union holidays are therefore observed by practically all mines. In addition to Eight-Hour Day (April 1) and Labor Day the anthracite miners celebrate Mitchell Day (October 29) in memory of the ending of the famous strike of 1902. Other holidays not observed in the nonunion bituminous fields, such as Memorial Day, Thanksgiving, and Armistice Day, are now generally celebrated in the anthracite region. Beginning with 1927 Washington's Birthday is counted as a half holiday. (See footnote to Table 5A.) In consequence, the theoretical working year for the anthracite mines is 303.5 days, a figure that makes no allowance for church holy days, many of which are so generally observed as to decrease production seriously.

TABLE 4A.—*Estimated weekly production of anthracite in 1929*

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 5	[1] 917,000	[1] 4	[2] 228,000	July 20	1,025,000	6	171,000
Jan. 12	1,685,000	6	281,000	July 27	1,242,000	6	207,000
Jan. 19	1,723,000	6	287,000	Aug. 3	1,243,000	6	207,000
Jan. 26	1,606,000	6	268,000	Aug. 10	1,063,000	6	177,000
Feb. 2	1,655,000	6	276,000	Aug. 17	1,072,000	6	179,000
Feb. 9	1,762,000	6	294,000	Aug. 24	1,487,000	6	248,000
Feb. 16	1,672,000	6	279,000	Aug. 31	1,613,000	6	269,000
Feb. 23	1,409,000	5.5	256,000	Sept. 7	1,218,000	5	244,000
Mar. 2	1,437,000	6	240,000	Sept. 14	1,434,000	6	239,000
Mar. 9	1,176,000	6	196,000	Sept. 21	1,564,000	6	261,000
Mar. 16	1,147,000	6	191,000	Sept. 28	1,980,000	6	330,000
Mar. 23	1,090,000	6	182,000	Oct. 5	1,862,000	6	310,000
Mar. 30	1,071,000	6	179,000	Oct. 12	1,884,000	6	314,000
Apr. 6	1,280,000	5	256,000	Oct. 19	1,895,000	6	316,000
Apr. 13	1,100,000	6	183,000	Oct. 26	1,822,000	6	304,000
Apr. 20	1,372,000	6	229,000	Nov. 2	1,218,000	5	244,000
Apr. 27	1,816,000	6	303,000	Nov. 9	1,524,000	6	254,000
May 4	1,573,000	6	262,000	Nov. 16	1,281,000	5	256,000
May 11	1,207,000	6	201,000	Nov. 23	1,323,000	6	221,000
May 18	1,389,000	6	232,000	Nov. 30	1,385,000	5	277,000
May 25	1,485,000	6	248,000	Dec. 7	1,852,000	6	309,000
June 1	1,219,000	5	244,000	Dec. 14	1,920,000	6	320,000
June 8	1,021,000	6	170,000	Dec. 21	1,795,000	6	299,000
June 15	1,175,000	6	196,000	Dec. 28	1,212,000	5	242,000
June 22	1,173,000	6	196,000	Jan. 4, 1930	[1] 601,000	[1] 2	[2] 261,000
June 29	1,352,000	6	225,000				
July 6	772,000	5	154,000		73,828,000	303.5	243,000
July 13	1,029,000	6	172,000				

[1] Figures represent the output and the number of working days in that part of the week included in the calendar year 1929. Figures of total production for the week of Jan. 5, 1929, are 1,138,000 tons, and for Jan. 4, 1930, 1,304,000 tons.

[2] Average daily production for the entire week and not for the working days that fell in the calendar year 1929.

Breakdown of stabilized operation.—Prior to the strike of 1925–26, anthracite production proceeded from month to month with only a moderate amount of variation. In normal years, free from labor disturbances, the output fluctuated within narrow limits and was never far short of the actual physical capacity of the mines. An unusually mild winter would sometimes cause a moderate decline; the variation was relatively slight, however, and for more than a decade output hovered in the neighborhood of 85,000,000 and 90,000,000 net tons a year.

The breakdown of stabilized operation can best be illustrated by comparing the monthly production of 1929 with that of 1924 in Table 5A. This table shows that, when allowance is made for months of unequal length and various holidays, production in 1924 was remarkably uniform throughout the year. In 1929, on the other hand, a distinct seasonal variation is evident; production slows down abruptly at the close of the heating season, is temporarily stimulated when the reduced prices are put into effect, but declines again to new low levels in the summer months and is only revived with the coming of colder weather. Of particular interest in connection with this table is the fact that in October and December, 1929, the output was actually greater than in the corresponding months of 1924, indicating that while the yearly production was 16 per cent less in 1929 than five years before, the physical capacity of the mines has changed very little.

TABLE 5A.—*Estimated monthly production of anthracite and average production per working day,[1] 1924–1929, in thousands of net tons*

Month	1924		1925		1926		1927		1928		1929	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	7,724	297	7,234	278	172	7	6,516	261	5,587	223	7,068	272
February	7,428	297	7,003	292	2,069	86	5,812	247	5,481	224	6,425	273
March	7,908	304	6,886	265	8,732	323	6,056	224	5,398	200	4,859	187
April	6,639	265	7,292	292	8,163	327	7,078	283	6,784	283	6,205	248
May	7,549	290	7,938	318	8,001	320	7,947	318	7,977	307	6,077	234
June	7,509	300	7,616	293	8,878	341	7,207	277	5,205	200	4,883	195
July	7,584	292	8,334	321	8,371	322	4,993	200	4,394	176	4,810	185
August	6,906	266	9,014	347	8,171	314	7,694	285	6,759	250	5,735	212
September	7,408	296	52	2	8,388	336	6,596	264	5,927	247	6,543	273
October	7,479	288	69	3	8,617	345	7,353	294	8,400	323	8,026	309
November	6,604	287	153	7	7,397	308	6,854	286	7,322	305	5,820	243
December	7,189	277	226	9	7,478	288	5,990	230	6,114	245	7,377	295
	87,927	288	61,817	203	84,437	278	80,096	264	75,348	248	73,828	243

[1] Production is estimated from weekly car loadings as reported by the American Railway Association, and includes mine fuel, coal sold locally, dredge coal, and the output of the Bernice Basin in Sullivan County. In computing the average rates per working day New Year's, Eight Hour Day (Apr. 1), Memorial Day, Independence Day, Labor Day, Mitchell Day (Oct. 29), Thanksgiving Day, Christmas and, since the war, Armistice Day have been counted as holidays. Beginning with 1927, Washington's Birthday is counted as a half holiday. No allowance, however, has been made for church holy days, which are observed by many of the miners. Monthly statistics from 1905 to 1922 will be found in Coal in 1925, pp. 427–428, and for 1923, in Coal in 1928, p. 581.

PRODUCTION IN THE LEHIGH, SCHUYLKILL, AND WYOMING REGIONS

The total production of Pennsylvania anthracite in 1929, including colliery fuel, local sales, and dredge and washery coal, was 65,918,031 gross tons, and the total value at the mines was $385,642,751. In comparison with 1928 this is a decrease of 2 per cent in both tonnage and value.

This decrease was chiefly accounted for by the Schuylkill region where production declined from 21,126,013 tons in 1928 to 19,223,195 tons in 1929, a decrease of 1,902,818 tons or 9 per cent. Production also fell off in the Bernice Basin in Sullivan County, but these losses were partly offset by substantial gains in the Wyoming and Lehigh regions. In the Wyoming region production advanced from 37,098,886 tons in 1928 to 37,470,574 tons in 1929, while the output of the Lehigh region increased from 8,911,942 tons to 9,114,152 tons. An analysis of production by regions is given in Table 6A.

Of the total production, 58,298,731 tons or 88.4 per cent consisted of shipments and 2,886,628 tons, of local sales made within the anthracite region or in the vicinity of the river dredges and the mines of Sullivan County. The sum of these two items—61,185,359 gross tons—constituted the "commercial production," and in 1929 it was valued at $377,592,892 or $6.17 per ton as compared with $6.19 per ton in 1928. In addition to shipments and local sales, 4,732,672 tons was used as colliery fuel in 1929. Its value for cost-keeping purposes is placed at $8,049,859.

It should be noted here that the figures giving value for the period 1926 to 1929 are strictly comparable with each other but not with those for earlier years. In 1926 a change was made in estimating the value of the production of one large company in the Wyoming region, which has reported its tonnage but not its value. The new method, fully explained in Coal in 1926 (pp. 555, 576–580), yields more accurate results than that formerly employed. The change, although slight, should be kept in mind when tables relating to values are considered.

TABLE 6A.—*Anthracite produced, by regions, 1928 and 1929*

Region	Shipments		Local sales		Used for power		Total	
	Gross tons	Value [1]	Gross tons	Value	Gross tons	Value	Gross tons	Value [1]
1928								
Lehigh:								
Breaker product	7, 865, 312	$47, 922, 067	355, 276	$1, 716, 465	611, 618	$1, 449, 729	8, 832, 206	$51, 088, 261
Dredge product	79, 736	103, 445					79, 736	103, 445
	7, 945, 048	48, 025, 512	355, 276	1, 716, 465	611, 618	1, 449, 729	8, 911, 942	51, 191, 706
Schuylkill:								
Breaker product	16, 853, 067	99, 891, 082	617, 380	3, 535, 658	2, 026, 536	3, 567, 125	19, 496, 983	106, 993, 865
Washery product	828, 816	1, 861, 236			37, 628	68, 513	866, 444	1, 929, 749
Dredge product	403, 495	322, 036	345, 885	383, 585	13, 206	12, 464	762, 586	718, 085
	18, 085, 378	102, 074, 354	963, 265	3, 919, 243	2, 077, 370	3, 648, 102	21, 126, 013	109, 641, 699
Wyoming:								
Breaker product	32, 809, 943	219, 151, 694	1, 496, 823	8, 351, 358	2, 327, 490	3, 351, 447	36, 634, 256	230, 854, 499
Washery product	416, 376	1, 136, 352	21, 343	132, 766	26, 911	46, 277	464, 630	1, 315, 395
	33, 226, 319	220, 288, 046	1, 518, 166	8, 484, 124	2, 354, 401	3, 397, 724	37, 098, 886	232, 169, 894
Sullivan County: Breaker product	107, 184	544, 883	6, 887	47, 245	24, 150	42, 263	138, 221	634, 391
Total breaker product	57, 635, 506	367, 509, 726	2, 476, 366	13, 650, 726	4, 989, 794	8, 410, 564	[2] 65, 101, 666	389, 571, 016
Total washery product	1, 245, 192	2, 997, 588	21, 343	132, 766	64, 539	114, 790	1, 331, 074	3, 245, 144
Total dredge product	483, 231	425, 481	345, 885	383, 585	13, 206	12, 464	842, 322	821, 530
Grand total	59, 363, 929	370, 932, 795	2, 843, 594	14, 167, 077	5, 067, 539	8, 537, 818	67, 275, 062	393, 637, 690

[1] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[2] Includes about 684,000 tons of culm-bank coal put through the breakers.

TABLE 6A.—*Anthracite produced, by regions, 1928 and 1929*—Continued

Region	Shipments		Local sales		Used for power		Total	
	Gross tons	Value	Gross tons	Value	Gross tons	Value	Gross tons	Value
1929								
Lehigh:								
Breaker product	8, 119, 806	$48, 874, 675	305, 888	$1, 632, 082	610, 564	$1, 454, 142	9, 036, 258	$51, 960, 899
Dredge product	77, 894	91, 136					77, 894	91, 136
	8, 197, 700	48, 965, 811	305, 888	1, 632, 082	610, 564	1, 454, 142	9, 114, 152	52, 052, 035
Schuylkill:								
Breaker product	15, 902, 804	93, 051, 030	639, 840	3, 484, 624	1, 764, 284	3, 092, 616	18, 306, 928	99, 628, 270
Washery product	322, 392	732, 231	2, 675	8, 016	28, 965	49, 889	354, 032	790, 136
Dredge product	211, 740	146, 991	349, 460	387, 196	1, 035	864	562, 235	535, 051
	16, 436, 936	93, 930, 252	991, 975	3, 879, 836	1, 794, 284	3, 143, 369	19, 223, 195	100, 953, 457
Wyoming:								
Breaker product	33, 221, 724	218, 680, 716	1, 580, 296	8, 438, 332	2, 300, 339	3, 404, 222	37, 102, 359	230, 523, 270
Washery product	361, 794	1, 523, 518	1, 062	4, 529	5, 359	8, 326	368, 215	1, 536, 373
	33, 583, 518	220, 204, 234	1, 581, 358	8, 442, 861	2, 305, 698	3, 412, 548	37, 470, 574	232, 059, 643
Sullivan County: Breaker product	80, 577	483, 055	7, 407	54, 761	22, 126	39, 800	110, 110	577, 616
Total breaker product	57, 324, 911	361, 089, 476	2, 533, 431	13, 609, 799	4, 697, 313	7, 990, 780	[3] 64, 555, 655	382, 690, 055
Total washery product	684, 186	2, 255, 749	3, 737	12, 545	34, 324	58, 215	722, 247	2, 326, 509
Total dredge product	289, 634	238, 127	349, 460	387, 196	1, 035	864	640, 129	626, 187
Grand total	58, 298, 731	363, 583, 352	2, 886, 628	14, 009, 540	4, 732, 672	8, 049, 859	65, 918, 031	385, 642, 751

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[3] Includes about 381,000 tons of culm-bank coal put through the breakers.

In Table 7A a comparison made on the basis of shipments shows the relative importance of the three principal producing regions (excluding Sullivan County) over a period extending back to the early days of the industry. Mining began in the Wyoming and then in the Lehigh region, but for the 30 years after 1830 the Schuylkill region was the largest producer. (Coal in 1923, p. 705, fig. 53.) After the Civil War the Wyoming region gained rapidly, and since 1885 has supplied 50 per cent or more of the shipments. During the last 20 years only slight temporary changes have occurred in the relative proportions shipped by the different regions. In 1929 the Wyoming region contributed 57.7 per cent of the shipments, the Schuylkill 28.2 per cent, and the Lehigh 14.1 per cent.

TABLE 7A.—*Anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1807–1929*

[Detailed figures for each year of the period 1820 to 1922 will be found in Coal in 1924, pp. 570–571. Beginning with 1914 the figures in this series include dredge shipments. Note, however, that Sullivan County is not included, because no record of it is available prior to 1890]

Year	Lehigh region		Schuylkill region		Wyoming region		Total (gross tons)
	Gross tons	Percentage	Gross tons	Percentage	Gross tons	Percentage	
1807	----------	----------	----------	----------	55	----------	55
1820	365	----------	----------	----------	----------	----------	365
1830	41, 750	23. 9	89, 984	51. 5	43, 000	24. 6	174, 734
1840	225, 313	26. 1	490, 596	56. 7	148, 470	17. 2	864, 379
1850	690, 456	20. 6	1, 840, 620	54. 8	827, 823	24. 6	3, 358, 899
1860	1, 821, 674	21. 4	3, 749, 632	44. 0	2, 941, 817	34. 6	8, 513, 123
1870	3, 239, 374	20. 0	4, 968, 157	30. 7	7, 974, 660	49. 3	16, 182, 191
1880	4, 463, 221	19. 0	7, 554, 742	32. 3	11, 419, 279	48. 7	23, 437, 242
1890	6, 329, 658	17. 3	10, 867, 822	29. 7	19, 417, 979	53. 0	36, 615, 459
1900	6, 918, 627	15. 3	13, 502, 732	30. 0	24, 686, 125	54. 7	45, 107, 484
1910	8, 627, 539	13. 3	17, 845, 020	27. 5	38, 433, 227	59. 2	64, 905, 786
1920	9, 939, 241	14. 6	20, 733, 428	30. 4	37, 517, 036	55. 0	68, 189, 705
1923	10, 154, 616	13. 9	22, 214, 576	30. 4	40, 777, 698	55. 7	73, 146, 890
1924	9, 288, 543	13. 5	19, 607, 200	28. 5	39, 917, 803	58. 0	68, 813, 546
1925	6, 719, 060	14. 0	13, 954, 495	29. 1	27, 229, 261	56. 9	47, 902, 816
1926	9, 398, 932	14. 0	18, 934, 971	28. 3	38, 709, 086	57. 7	67, 042, 989
1927	8, 778, 802	14. 0	18, 866, 778	30. 0	35, 178, 302	56. 0	62, 823, 882
1928	7, 945, 048	13. 4	18, 085, 378	30. 5	33, 226, 319	56. 1	59, 256, 745
1929	8, 197, 700	14. 1	16, 436, 936	28. 2	33, 583, 518	57. 7	58, 218, 154

PRODUCTION, BY FIELDS AND COUNTIES

The classification by trade regions—Lehigh, Schuylkill, and Wyoming—is the one most commonly used by the trade. It is paralleled by the organization of the United Mine Workers, in which district No. 1 corresponds to the Wyoming trade region, district No. 7 to the Lehigh region, and district No. 9 to the Schuylkill region. In studies of costs of production and reserves, however, a classification adopted by geologists is more useful because it corresponds more closely to the natural conditions that largely govern mining costs. The geologic classification recognizes four fields—the Northern, Eastern Middle, Western Middle, and Southern. The Northern field is identical with the Wyoming region. That part of the Southern field lying east of Tamaqua, known as the Panther Creek Valley, and the Eastern Middle field make up the Lehigh region. The part of the Southern field west of Tamaqua and the Western Middle field compose the Schuylkill. The Bernice Basin in Sullivan County is sometimes grouped with the Northern field.

The geological conditions encountered in these four producing fields vary considerably. Mining conditions are most favorable in the Northern and Eastern Middle fields, where the beds are generally thicker and less faulted and folded than in the Western Middle and Southern fields. These differences affect the cost of mining. In the Northern and Eastern Middle fields the output per man has been relatively high and the cost of production correspondingly low. These advantages, however, have so stimulated production that most of the easily accessible coal has been extracted in many of the collieries in these areas. Exhaustion of the virgin coal and the necessity of resorting to second or even third mining has offset the natural advantages, and to-day the average output per man differs little from that in the Western Middle and Southern fields where the natural handicaps were originally more severe. In 1929 the Southern field had the highest output per man underground per day—2.65 gross tons—while the Northern field made the poorest showing with an average of 2.21 tons per man underground per day. The average for all fields in 1929 was 2.36 tons. (See Table 8A.)

Natural conditions also have an important bearing on the value of the product. In the Northern and Eastern Middle fields the yield of the profitable domestic sizes is high. In the Western Middle and particularly in the Southern field it is low because of crushing of the coal by the faulting and folding of the beds. With respect to the percentage of domestic sizes shipped, the Northern and Eastern Middle fields still hold a decided advantage over the Western Middle and Southern fields. In 1929 the proportion of domestic sizes in breaker shipments in the Northern field was 75.2 per cent and in the Eastern Middle, 72.2 per cent, as compared with 68.1 per cent for the Western Middle and 59.9 per cent for the Southern field. The average for all fields in 1929 was 71.5 per cent.

TABLE 8A.—*Daily output of deep-mined anthracite per man underground and per cent of domestic sizes in breaker shipments, by fields, 1927–1929*

Field	1927		1928		1929	
	Gross tons of deep-mined coal produced per man underground per day [1]	Per cent of domestic sizes in breaker shipments	Gross tons of deep-mined coal produced per man underground per day [1]	Per cent of domestic sizes in breaker shipments	Gross tons of deep-mined coal produced per man underground per day [1]	Per cent of domestic sizes in breaker shipments
Northern	2.20	76.0	2.18	75.4	2.21	75.2
Eastern Middle	2.38	71.4	2.54	73.3	2.63	72.2
Western Middle	2.39	68.3	2.50	67.7	2.53	68.1
Southern	2.58	56.5	2.56	58.4	2.65	59.9
Average	2.30	71.2	2.32	71.2	2.36	71.5

[1] Excluding culm-bank and strip-pit coal. In 1926 the corresponding figures were: Northern 2.20; Eastern Middle, 2.34; Western Middle, 2.30; and Southern, 2.42.

Details of breaker, washery, and dredge product for each field from 1919 to 1929 are given in Table 9A.

TABLE 9A.—*Anthracite produced, by fields, 1919–1929, in gross tons*

[The figures of breaker product include a certain quantity of culm-bank coal, which in 1929 amounted to about 381,000 tons. Data for 1913–1918 will be found in Coal in 1925, p. 517]

Year	Northern field [1]				Eastern Middle field			Western Middle field			
	Breakers	Washeries	Dredges	Total	Breakers	Washeries	Total	Breakers	Washeries	Dredges	Total
1919	41, 650, 000	1, 801, 000	18, 000	43, 469, 000	7, 284, 000	288, 000	7, 572, 000	14, 983, 000	871, 000	247, 000	16, 101, 000
1920	40, 398, 000	2, 939, 000	29, 000	43, 366, 000	7, 010, 000	115, 000	7, 125, 000	16, 123, 000	942, 000	240, 000	17, 305, 000
1921	44, 629, 000	920, 000	35, 000	45, 584, 000	6, 862, 000	78, 000	6, 940, 000	16, 674, 000	319, 000	199, 000	17, 192, 000
1922	24, 971, 000	1, 032, 000	48, 000	26, 051, 000	4, 121, 000	36, 000	4, 157, 000	9, 651, 000	995, 000	194, 000	10, 840, 000
1923	43, 804, 000	1, 859, 000	28, 000	45, 691, 000	7, 039, 000	122, 000	7, 161, 000	16, 548, 000	1, 019, 000	194, 000	17, 761, 000
1924	44, 071, 000	552, 000	14, 000	44, 637, 000	6, 808, 000	6, 000	6, 814, 000	15, 136, 000	423, 000	204, 000	15, 763, 000
1925	30, 184, 000	359, 000	78, 000	30, 621, 000	4, 909, 000	----------	4, 909, 000	10, 633, 000	334, 000	248, 000	11, 215, 000
1926	42, 290, 000	701, 000	16, 000	43, 007, 000	6, 446, 000	18, 000	6, 464, 000	14, 483, 000	441, 000	255, 000	15, 179, 000
1927	38, 874, 000	557, 000	----------	39, 431, 000	6, 178, 000	----------	6, 178, 000	13, 673, 000	832, 000	351, 000	14, 856, 000
1928	36, 772, 000	465, 000	----------	37, 237, 000	5, 827, 000	----------	5, 827, 000	12, 908, 000	651, 000	361, 000	13, 920, 000
1929	37, 213, 000	368, 000	----------	37, 581, 000	6, 054, 000	----------	6, 054, 000	12, 121, 000	241, 000	200, 000	12, 562, 000

Year	Southern field				Total			
	Breakers	Washeries	Dredges	Total	Breakers	Washeries	Dredges	Total
1919	10, 245, 000	913, 000	354, 000	11, 512, 000	74, 162, 000	3, 873, 000	619, 000	78, 654, 000
1920	10, 137, 000	1, 673, 000	392, 000	12, 202, 000	73, 668, 000	5, 669, 000	661, 000	79, 998, 000
1921	10, 341, 000	400, 000	323, 000	11, 064, 000	78, 506, 000	1, 717, 000	557, 000	80, 780, 000
1922	6, 331, 000	880, 000	565, 000	7, 776, 000	45, 074, 000	2, 943, 000	807, 000	48, 824, 000
1923	11, 077, 000	1, 016, 000	632, 000	12, 725, 000	78, 468, 000	4, 016, 000	854, 000	83, 338, 000
1924	10, 654, 000	119, 000	519, 000	11, 292, 000	76, 669, 000	1, 100, 000	737, 000	78, 506, 000
1925	7, 639, 000	229, 000	581, 000	8, 449, 000	53, 365, 000	922, 000	907, 000	55, 194, 000
1926	10, 157, 000	38, 000	546, 000	10, 741, 000	73, 376, 000	1, 198, 000	817, 000	75, 391, 000
1927	10, 415, 000	117, 000	517, 000	11, 049, 000	69, 140, 000	1, 506, 000	868, 000	71, 514, 000
1928	9, 595, 000	215, 000	481, 000	10, 291, 000	65, 102, 000	1, 331, 000	842, 000	67, 275, 000
1929	9, 168, 000	113, 000	440, 000	9, 721, 000	64, 556, 000	722, 000	640, 000	65, 918, 000

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[1] Includes Sullivan County, which in 1929 contributed 110,110 tons of breaker product.

For those who may be interested in a segregation by political units Table 10A gives the breakdown of production by counties for 1929 with comparative figures for the previous year. From this table it will be seen that while anthracite is produced in 19 counties, production is concentrated chiefly in Luzerne, Lackawanna, Schuylkill, Northumberland, Carbon, and Dauphin Counties. These six counties normally account for over 98 per cent of the total output. Luzerne County is by far the most important producer, with Lackawanna and Schuylkill Counties competing for second place and Northumberland, Carbon, and Dauphin ranking next in the order named.

In 1929, 26,151,000 tons or almost 40 per cent of the total production came from Luzerne County, 15,373,000 tons or 23.3 per cent from Lackawanna County, 15,124,000 tons or 22.9 per cent from Schuylkill County, 5,415,000 tons or 8.2 per cent from Northumberland County, 1,785,000 tons or 2.7 per cent from Carbon County, and 1,012,000 tons or 1.5 per cent from Dauphin County. The remaining 1,058,000 tons or 1.6 per cent was divided among the 13 small producing counties.

TABLE 10A.—*Anthracite produced, by counties, 1928 and 1929*

County	Shipments		Local sales	
	Gross tons	Value [1]	Gross tons	Value
1928				
Carbon	1, 581, 000	$8, 696, 000	38, 000	$252, 000
Columbia	393, 000	1, 978, 000	34, 000	76, 000
Dauphin	690, 000	3, 884, 000	221, 000	351, 000
Lackawanna	13, 262, 000	86, 928, 000	577, 000	3, 435, 000
Luzerne	23, 194, 000	154, 900, 000	1, 212, 000	6, 211, 000
Northumberland	5, 221, 000	28, 292, 000	203, 000	1, 006, 000
Schuylkill	14. 369, 000	83, 040, 000	464, 000	2, 585, 000
Sullivan	107, 000	545, 000	7, 000	47, 000
Susquehanna and Wayne	404, 000	2, 511, 000	15, 000	94, 000
Berks, Cumberland, Lancaster, Lebanon, Lehigh, Montour, Northampton, Snyder, and York [2]	143, 000	159, 000	72, 000	110, 000
	59, 364, 000	370, 933, 000	2, 843, 000	14, 167, 000
1929				
Carbon	1, 658, 000	9, 292, 000	40, 000	260, 000
Columbia	247, 000	1, 530, 000	29, 000	75, 000
Dauphin	687, 000	4, 122, 000	221, 000	372, 000
Lackawanna	13, 947, 000	90, 328, 000	622, 000	3, 525, 000
Luzerne	23, 148, 000	152, 573, 000	1, 170, 000	5, 968, 000
Northumberland	4, 747, 000	26, 082, 000	222, 000	955, 000
Schuylkill	13, 307, 000	76, 774, 000	472, 000	2, 601, 000
Sullivan	81, 000	483, 000	7, 000	55, 000
Susquehanna and Wayne	375, 000	2, 293, 000	15, 000	84, 000
Berks, Cumberland, Lebanon, Lehigh, Montour, Northampton, Perry, and York [2]	102, 000	106, 000	88, 000	115, 000
	58, 299, 000	363, 583, 000	2, 886, 000	14, 010, 000

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[1] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[2] Counties producing dredge coal only.

TABLE 10A.—*Anthracite produced, by counties, 1928 and 1929*—Continued

County	Used for power		Total	
	Gross tons	Value	Gross tons	Value [1]
1928				
Carbon	80, 000	$234, 000	1, 699, 000	$9, 182, 000
Columbia	56, 000	98, 000	483, 000	2, 152, 000
Dauphin	121, 000	213, 000	1, 032, 000	4, 448, 000
Lackawanna	757, 000	1, 095, 000	14, 596, 000	91, 458, 000
Luzerne	1, 946, 000	3, 123, 000	26, 352, 000	164, 234, 000
Northumberland	540, 000	931, 000	5, 964, 000	30, 229, 000
Schuylkill	1. 508, 000	2, 751, 000	16, 341, 000	88, 376, 000
Sullivan	24, 000	42, 000	138, 000	634, 000
Susquehanna and Wayne	35, 000	50, 000	454, 000	2, 655, 000
Berks, Cumberland, Lancaster, Lebanon, Lehigh, Montour, Northampton, Snyder, and York [2]	1, 000	1, 000	216, 000	270, 000
	5, 068, 000	8, 538, 000	67, 275, 000	393, 638, 000
1929				
Carbon	87, 000	274, 000	1, 785, 000	9, 826, 000
Columbia	52, 000	93, 000	328, 000	1, 698, 000
Dauphin	104, 000	181, 000	1, 012, 000	4, 675, 000
Lackawanna	804, 000	1, 200, 000	15, 373, 000	95, 053, 000
Luzerne	1, 833, 000	2, 955, 000	26, 151, 000	161, 496, 000
Northumberland	446, 000	773, 000	5, 415, 000	27, 810, 000
Schuylkill	1, 345, 000	2, 475, 000	15, 124, 000	81, 850, 000
Sullivan	22, 000	40, 000	110, 000	578, 000
Susquehanna and Wayne	40, 000	59, 000	430, 000	2, 436, 000
Berks, Cumberland, Lebanon, Lehigh, Montour, Northampton, Perry, and York [2]	----------	----------	190, 000	221, 000
	4, 733, 000	8, 050, 000	65, 918, 000	385, 643, 000

[1] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[2] Counties producing dredge coal only.

FRESH-MINED AND CULM-BANK COAL, BREAKER AND WASHERY PRODUCT

Reconciliation of fresh-mined, culm-bank, and breaker product.—Anthracite is now produced from three sources—from mines, from old culm banks, and from the rivers that drain the anthracite region. As all three sources contribute to the country's supply, it is important to cover them all in order to ascertain the total production. A full explanation of the method used in reconciling figures on production from the three sources is given in Coal in 1926, pages 562 and 563. No difficulty is experienced in separating the figures of production by dredges. It is difficult to draw a sharp line that can be maintained throughout the statistics of the industry, however, between the fresh-mined and the culm-bank coal.

As the best solution of this problem the individual breaker, washery, or dredge is taken as the unit in compiling the statistics. The producing companies are asked to supply separate statements for each breaker, washery, or dredge. These are totaled to form the primary tables of this report in order to show the total quantity of breaker product, washery product, and dredge product, with related figures of value, number of employees, and time worked.

The figures of breaker and washery product, however, are not exactly equivalent to the fresh-mined and culm-bank coal because of the practice sometimes adopted of putting culm-bank coal through a breaker, either directly from the bank or after preliminary treatment in a washery. To obtain accurate statistics of the culm-bank coal, each company is now asked to recapitulate its total production of fresh-mined and culm-bank coal. The results are shown in Table 11A.

TABLE 11A.—*Comparison of anthracite production in 1923–1929, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, in gross tons*

[Data in this form were not collected prior to 1923. See Coal in 1923, pp. 697–700, for interpretation of the records of fresh-mined and washery coal before that year]

	Classified by source of coal	Classified by type of preparation plant	Difference
1923			
Fresh-mined coal	76, 135, 538		+2, 332, 837
Breaker product		78, 468, 375	
Culm-bank coal	[1] 6, 348, 963		−2, 332, 837
Washery product		4, 016, 126	
River coal	853, 900		
Dredge product		853, 900	
	83, 338, 401	83, 338, 401	
1924			
Fresh-mined coal	75, 656, 355		+1, 013, 000
Breaker product		76, 669, 355	
Culm-bank coal	[1] 2, 112, 813		−1, 013, 000
Washery product		1, 099, 813	
River coal	736, 959		
Dredge product		736, 959	
	78, 506, 127	78, 506, 127	
1925			
Fresh-mined coal	52, 437, 725		+927, 000
Breaker product		53, 364, 725	
Culm-bank coal	[1] 1, 849, 276		−927, 000
Washery product		922, 276	
River coal	906, 882		
Dredge product		906, 882	
	55, 193, 883	55, 193, 883	
1926			
Fresh-mined coal	71, 839, 920		+1, 536, 000
Breaker product		73, 375, 920	
Culm-bank coal	[1] 2, 733, 908		−1, 536, 000
Washery product		1, 197, 908	
River coal	816, 754		
Dredge product		816, 754	
	75, 390, 582	75, 390, 582	
1927			
Fresh-mined coal	67, 688, 369		+1, 452, 000
Breaker product		69, 140, 369	
Culm-bank coal	[1] 2, 957, 833		−1, 452, 000
Washery product		1, 505, 833	
River coal	867, 694		
Dredge product		867, 694	
	71, 513, 896	71, 513, 896	
1928			
Fresh-mined coal	64, 417, 666		+684, 000
Breaker product		65, 101, 666	
Culm-bank coal	[1] 2, 015, 074		−684, 000
Washery product		1, 331, 074	
River coal	842, 322		
Dredge product		842, 322	
	67, 275, 062	67, 275, 062	
1929			
Fresh-mined coal	64, 174, 655		+381, 000
Breaker product		64, 555, 655	
Culm-bank coal	[1] 1, 103, 247		−381, 000
Washery product		722, 247	
River coal	640, 129		
Dredge product		640, 129	
	65, 918, 031	65, 918, 031	

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[1] Includes about 2,300,000 tons of coal put through the breakers in 1923, 1,013,000 tons in 1924, 927,000 tons in 1925, 1,536,000 tons in 1926, 1,452,000 tons in 1927, 684,000 tons in 1928, and 381,000 tons in 1929.

Out of 64,555,655 tons handled by breakers in 1929, 381,000 tons was culm-bank coal. The fresh-mined coal amounted to 64,174,655 tons. The quantity handled by the washeries was 722,247 tons, but including the 381,000 tons of bank coal run through the breakers the total produced from culm banks was 1,103,247 tons.

Culm-bank coal.—Owing to the gradual cleaning up of the old culm banks and to adverse market conditions, the quantity of culm-bank coal recovered has declined sharply in recent years. In 1929 the tonnage produced from the culm banks was only slightly more than half of the output in the preceding year, and in comparison with the 6,348,963 tons recovered from the banks in 1923 the total for 1929 shows a decrease of nearly 83 per cent.

The practice of treating culm-bank coal in breakers is most common in the Western Middle and Southern fields. Table 12A shows that of the 381,000 tons of culm-bank coal put through the breakers in 1929 the Southern field accounted for 199,000 tons, the Western Middle for 104,000 tons, the Northern for 65,000 tons, and the Eastern Middle for 13,000 tons.

TABLE 12A.—*Culm-bank coal put through breakers, by fields, 1924–1929, in gross tons*

Year	Northern	Eastern Middle	Western Middle	Southern	Total
1924	170,000	220,000	386,000	237,000	1,013,000
1925	173,000	181,000	396,000	177,000	927,000
1926	271,000	230,000	542,000	493,000	1,536,000
1927	313,000	273,000	333,000	533,000	1,452,000
1928	77,000	87,000	279,000	241,000	684,000
1929	65,000	13,000	104,000	199,000	381,000

Anthracite shipped from breakers, washeries, and dredges since 1890.—By limiting the comparison to shipments the relative growth of breaker, washery, and dredge operations since 1890 can be shown. (Table 13A.) Washery shipments began to assume importance in the late nineties and reached their maximum in 1918 with 6,506,000 tons. Since the war the tendency has been downward, and in 1929 the washery shipments were smaller than at any time since 1897. The first statistical record of shipments by dredges was in 1909, when 9,000 tons was sold. The maximum tonnage of river coal was shipped in 1922.

TABLE 13A.—*Anthracite shipped from breakers, washeries, and dredges, 1890–1929, in gross tons*

[Includes shipments for Sullivan County, except for 1895, for which no data are available. Detailed figures for each year of the period up to 1924 will be found in Coal in 1924, p. 574]

Year	Breakers [1]	Washeries [1]	Dredges	Total
1890	36,573,000	42,000		36,615,000
1895	45,430,000	1,081,000		46,511,000
1900	43,218,000	2,059,000		45,277,000
1905	59,010,000	2,644,000		61,654,000
1910	62,417,000	3,296,000	22.000	65,735,000
1915	66,174,000	2,475,000	17,000	68,666,000
1917	72,077,000	5,366,000	47,000	77,490,000
1918	70,090,000	6,506,000	125,000	76,721,000
1919	64,632,000	3,017,000	323,000	67,972,000
1920	63,599,000	4,616,000	396,000	68,611,000
1921	67,981,000	1,308,000	265,000	69,554,000
1922	37,907,000	2,600.000	567,000	41,074,000
1923	69,289,000	3,754,000	385,000	73,428,000
1924	67,592,000	1,060,000	319,000	68,971,000
1925	46,615,000	872,000	520,000	48,007,000
1926	65,826,000	1,068,000	355,000	67,249,000
1927	61,130,000	1,317,000	495,000	62,942,000
1928	57,636,000	1,245,000	483,000	59,364,000
1929	57,325,000	684,000	290,000	58,299,000

[1] Includes about 2,300,000 tons of coal put through the breakers in 1923, 1,013,000 tons in 1924, 927,000 tons in 1925, 1,536,000 tons in 1926, 1,452,000 tons in 1927, 684,000 tons in 1928, and 381,000 tons in 1929.

DETAILS OF SHIPMENTS, BY REGIONS AND SIZES

As previously pointed out the yield of the profitable domestic sizes varies considerably in the different regions, owing to the geological conditions encountered in mining. Table 14A gives the details of shipments by sizes and regions for the last two years. It will be noted from this table that of the breaker product the proportion of domestic sizes was highest in the Wyoming region, where the domestic sizes comprised 75.3 per cent of the shipments, and was lowest in the Schuylkill region, where only 65.2 per cent of the breaker shipments was domestic coal. The average for all regions, including Sullivan County, was 71.5 per cent.

TABLE 14A.—*Anthracite shipped, by regions and sizes, 1928 and 1929, in gross tons*

[The figures of shipments from breakers include a considerable tonnage of culm-bank coal handled in the breakers]

Size	Breaker shipments					Washery shipments	Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total			
1928								
Broken	18,785	113,195	250,035	--------	382,015	--------	--------	382,015
Egg	625,746	1,498,261	4,619.295	4,338	6,747,640	844	--------	6,748,484
Stove	1,862,280	3,785,452	9,091,430	19,824	14,758,986	19,426	--------	14,778,412
Chestnut	2,092,083	4,055,613	8,489,278	25,303	14,662,277	98,568	--------	14,760,845
Pea	725,231	1,453,715	2,316,486	8,369	4,503,801	92,874	--------	4,596,675
Total domestic	5,324,125	10,906,236	24,766,524	57,834	41,054,719	211,712	--------	41,266,431
Buckwheat No. 1	1,054,588	2,637,767	3,910,190	--------	7,602,545	227,744	(1)	7,830,289
Buckwheat No. 2 (rice)	665,029	1,267,060	2,552,919	--------	4,485,008	302,052	[1] 12,818	4,799,878
Buckwheat No. 3 (barley)	740,837	1,784,232	1,417,490	--------	3,942,559	438,139	304,372	4,685,070
Boiler	--------	7,132	21,736	(2)	28,868	--------	56,439	85,307
Other[3]	80,733	250,640	141,084	[2] 49,350	521,807	65,545	109,602	696,954
Total steam	2,541,187	5,946,831	8,043,419	49,350	16,580,787	1,033,480	483,231	18,097,498
Grand total	7,865,312	16,853,067	32,809,943	107,184	57,635,506	1,245,192	483,231	59,363,929
1929								
Lump[4] and broken	14,589	127,073	193,625	125	335,412	1,216	--------	336,628
Egg	609,483	1,420,715	4,506,713	5,864	6,542,775	23,817	--------	6,566,592
Stove	2,008,164	3,602,727	9,130,835	21,149	14,762,875	59,583	--------	14,822,458
Chestnut	2,145,166	3,900,015	8,618,261	20,938	14,684,380	100,920	--------	14,785,300
Pea	749,551	1,326,014	2,554,345	6,205	4,636,115	50,742	--------	4,686,857
Total domestic	5,526,953	10,376,544	25,003,779	54,281	40,961,557	236,278	--------	41,197,835
Buckwheat No. 1	1,108,924	2,483,540	3,975,122	2,127	7,569,713	106,227	(1)	7,675,940
Buckwheat No. 2 (rice)	625,986	1,129,686	2,435,399	1,394	4,192,465	119,877	[1] 3,219	4,315,561
Buckwheat No. 3 (barley)	805,933	1,652,660	1,535.408	769	3,994,770	175,404	183,907	4,354,081
Boiler	--------	30,490	25,990	18	56.498	9,587	(2)	66,085
Other[3]	52,010	229,884	246,026	21,988	549,908	36,813	[2] 102,508	689,229
Total steam	2,592,853	5,526,260	8,217,945	26,296	16,363,354	447,908	289,634	17,100,896
Grand total	8,119,806	15,902,804	33,221,724	80,577	57,324,911	684,186	289,634	58,298,731

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[1] A small amount of buckwheat No. 1 is included with buckwheat No. 2.

[2] A small amount of boiler coal is included with "Other" sizes.

[3] Includes buckwheat No. 4, silt, culm, screenings, mine-run coal, slush, and unsized coal smaller than pea.

[4] The quantity of lump included is insignificant.

TABLE 15A.—*Value of anthracite shipped, by regions and sizes, 1928 and 1929* [1]

Size	Breaker shipments										Washery shipments		Dredge shipments		Grand total	
	Lehigh region		Schuylkill region		Wyoming region		Sullivan County		Total							
	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton
1928																
Broken	$151,001	$8.04	$971,462	$8.58	$1,972,947	$7.89			$3,095,410	$8.10					$3,095,410	$8.10
Egg	5,221,968	8.35	12,554,657	8.38	38,364,872	8.31	$36,702	$8.46	56,178,199	8.33	$7,119	$8.43			56,185,318	8.33
Stove	16,295,512	8.75	33,336,854	8.81	78,922,665	8.68	168,380	8.49	128,723,411	8.72	138,832	7.15			128,862,243	8.72
Chestnut	17,405,264	8.32	33,985,314	8.38	70,232,543	8.27	212,136	8.38	121,835,257	8.31	647,059	6.56			122,482,316	8.30
Pea	3,630,789	5.01	7,212,148	4.96	11,614,254	5.01	42,255	5.05	22,499,446	5.00	421,286	4.54			22,920,732	4.99
Total domestic	42,704,534	8.02	88,060,435	8.07	201,107,281	8.12	459,473	7.94	332,331,723	8.09	1,214,296	5.74			333,546,019	8.08
Buckwheat No. 1	2,880,065	2.73	6,987,417	2.65	11,028,920	2.82			20,896,402	2.75	597,545	2.62	(2)	(2)	21,493,947	2.74
Buckwheat No. 2 (rice)	1,267,115	1.91	2,240,190	1.77	4,790,194	1.88			8,297,499	1.85	540,437	1.79	[2] $12,374	[2] $0.97	8,850,310	1.84
Buckwheat No. 3 (barley)	1,034,694	1.40	2,432,640	1.36	1,989,737	1.40			5,457,071	1.38	600,528	1.37	263,546	.87	6,321,145	1.35
Boiler			2,885	.40	25,090	1.15	(3)	(3)	27,975	.97			64,033	1.13	92,008	1.08
Other	35,659	.44	167,515	.67	210,472	1.49	[3] 85,410	[3] 1.73	499,056	.96	44,782	.68	85,528	.78	629,366	.90
Total steam	5,217,533	2.05	11,830,647	1.99	18,044,413	2.24	85,410	1.73	35,178,003	2.12	1,783,292	1.73	425,481	.88	37,386,776	2.07
Grand total	47,922,067	6.09	99,891,082	5.93	219,151,694	6.68	544,883	5.08	367,509,726	6.38	2,997,588	2.41	425,481	.88	370,932,795	6.25
1929																
Lump [4] and broken	116,138	7.96	1,038,373	8.17	1,505,920	7.78	1,000	8.00	2,661,431	7.93	9,500	7.81			2,670,931	7.93
Egg	5,001,982	8.21	11,745,175	8.27	36,746,797	8.15	49,761	8.49	53,543,715	8.18	194,467	8.17			53,738,182	8.18
Stove	17,364,936	8.65	31,681,134	8.79	79,515,331	8.71	178,867	8.46	128,740,268	8.72	439,404	7.37			129,179,672	8.72
Chestnut	17,819,883	8.31	32,153,302	8.24	70,991,244	8.24	172,547	8.24	121,136,976	8.25	677,941	6.72			121,814,917	8.24
Pea	3,450,489	4.60	6,027,556	4.55	12,097,421	4.74	32,095	5.17	21,607,561	4.66	206,018	4.06			21,813,579	4.65
Total domestic	43,753,428	7.92	82,645,540	7.96	200,856,713	8.03	434,270	8.00	327,689,951	8.00	1,527,330	6.46			329,217,281	7.99
Buckwheat No. 1	2,894,573	2.61	6,204,721	2.50	10,801,026	2.72	5,800	2.73	19,906,120	2.63	272,797	2.57	(2)	(2)	20,178,917	2.63
Buckwheat No. 2 (rice)	1,139,222	1.82	1,917,554	1.70	4,380,111	1.80	2,500	1.79	7,439,387	1.77	197,802	1.65	[2] 3,945	[2] 1.23	7,641,134	1.77
Buckwheat No. 3 (barley)	1,068,930	1.33	2,138,560	1.29	2,113,772	1.38	1,100	1.43	5,322,362	1.33	224,480	1.28	168,277	.92	5,715,119	1.31
Boiler			10,682	.35	17,504	.67	12	.67	28,198	.50	7,436	.78	(3)	(3)	35,634	.54
Other	18,522	.36	133,973	.58	511,590	2.08	39,373	1.79	703,458	1.28	25,904	.70	[3] 65,905	[3] .64	795,267	1.15
Total steam	5,121,247	1.98	10,405,490	1.88	17,824,003	2.17	48,785	1.86	33,399,525	2.04	728,419	1.63	238,127	.82	34,366,071	2.01
Grand total	48,874,675	6.02	93,051,030	5.85	218,680,716	6.58	483,055	5.99	361,089,476	6.30	2,255,749	3.30	238,127	.82	363,583,352	6.24

[1] Value given is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.
[2] A small amount of buckwheat No. 1 is included with buckwheat No. 2.
[3] A small amount of boiler coal is included with "Other" sizes.
[4] The quantity of lump included is insignificant.

TRENDS IN SIZES SHIPPED

Details of the quantity and value of each size shipped in 1928 and 1929 are given by regions in Tables 14A and 15A. Table 16A shows the relative percentage of each size in the total shipments of breaker coal from 1922 to 1929.

The total shipments of steam sizes, including dredge and washery coal, declined from 18,097,498 tons in 1928 to 17,100,896 tons in 1929, a decrease of 5.5 per cent. Shipments of domestic sizes, on the other hand, show a much more moderate decline, being only 68,596 tons, or 0.2 per cent, less than in the previous year.

Within the group of domestic sizes the relative proportions of each size are affected by changes in the standards of sizing that have been made from time to time. In view of certain revisions undertaken in 1925 and the recommendation for further improvement of preparation standards in 1928, special interest attaches to a comparison between the relative proportions of the five principal domestic sizes in 1928 and those in four preceding years. The following figures, abstracted from Table 16A, represent percentages of the total breaker shipments for the year:

	1923	1924	1926	1927	1928	1929
Broken	5.0	2.7	1.6	1.0	0.7	0.6
Egg	15.7	14.5	13.5	11.7	11.7	11.4
Stove	19.6	22.2	25.1	25.9	25.6	25.8
Chestnut	25.6	26.5	27.1	26.4	25.4	25.6
Pea	8.0	8.3	5.5	6.2	7.8	8.1

TABLE 16A.—*Sizes of anthracite shipped from breakers, by regions, 1922–1929, in per cent of total*

[Note that shipments of dredge and washery coal are not included]

Region and size of coal	Percentage of total shipments							
	1922	1923	1924	1925	1926	1927	1928	1929
Lehigh:								
Lump	--------	--------	--------	--------	(1)	(2)	--------	(1)
Broken	1.8	1.7	1.0	1.1	0.5	[2]0.4	0.2	0.2
Egg	12.7	14.7	13.1	11.5	9.3	7.8	8.0	7.5
Stove	18.8	17.8	19.6	22.0	21.9	23.2	23.7	24.8
Chestnut	25.3	25.4	26.1	26.9	25.8	25.9	26.6	26.4
Pea	11.3	9.6	9.5	7.4	7.5	7.9	9.2	9.2
Total domestic	69.9	69.2	69.3	68.9	65.0	65.2	67.7	68.1
Buckwheat No. 1	14.7	14.3	13.7	12.8	11.7	12.7	13.4	13.7
Buckwheat No. 2 (rice)	7.8	7.4	7.1	7.6	7.3	8.4	8.5	7.7
Buckwheat No. 3 (barley)	6.7	7.7	8.7	8.6	10.7	10.8	9.4	9.9
Boiler	.2	.2	(1)	(1)	2.0	--------	--------	--------
Other	.7	1.2	1.2	2.1	3.3	2.9	1.0	.6
Total steam	30.1	30.8	30.7	31.1	35.0	34.8	32.3	31.9
Schuylkill:								
Lump	(1)	.1	.1	(1)	(1)	(2)	--------	(1)
Broken	3.5	3.5	1.7	1.5	.9	[2].8	.6	.8
Egg	11.3	12.5	11.6	10.0	10.4	9.9	8.9	8.9
Stove	20.0	18.0	20.6	22.3	23.5	21.8	22.5	22.7
Chestnut	[3]25.0	23.3	24.3	24.9	26.0	25.0	24.1	24.5
Pea	8.9	10.0	10.1	7.5	7.3	7.2	8.6	8.3
Total domestic	68.7	67.4	68.4	66.2	68.1	64.7	64.7	65.2
Buckwheat No. 1	16.2	16.9	15.4	14.4	12.8	15.0	15.7	15.6
Buckwheat No. 2 (rice)	6.2	6.4	5.7	7.9	8.1	8.2	7.5	7.1
Buckwheat No. 3 (barley)	7.8	8.5	9.8	10.5	9.9	10.6	10.6	10.4
Boiler	.2	(1)	(1)	(1)	.1	(1)	(1)	.2
Other	.9	.8	.7	1.0	1.0	1.5	1.5	1.5
Total steam	31.3	32.6	31.6	33.8	31.9	35.3	35.3	34.8

[1] Less than one-tenth of 1 per cent.
[2] A small amount of lump coal is included with broken.
[3] Includes range coal.

TABLE 16A.—*Sizes of anthracite shipped from breakers, by regions, 1922–1929, in per cent of total*—Continued

Region and size of coal	Percentage of total shipments							
	1922	1923	1924	1925	1926	1927	1928	1929
Wyoming:								
Lump	--------	--------	--------	--------	--------	--------	--------	--------
Broken	5.3	6.6	3.6	3.6	2.2	1.3	0.7	0.6
Egg	16.6	17.7	16.2	15.8	16.0	13.5	14.1	13.6
Stove	23.1	20.9	23.5	25.9	26.7	28.7	27.7	27.5
Chestnut	[3] 26.5	[3] 26.8	[3] 27.8	[3] 27.6	[3] 27.9	27.3	25.9	25.9
Pea	6.4	6.5	7.1	4.2	4.1	5.3	7.1	7.7
Total domestic	77.9	78.5	78.2	77.1	76.9	76.1	75.5	75.3
Buckwheat No. 1	11.2	10.6	10.5	11.3	10.8	11.8	11.9	12.0
Buckwheat No. 2 (rice)	6.5	6.5	6.7	7.2	7.5	7.1	7.8	7.3
Buckwheat No. 3 (barley)	3.5	3.8	3.8	3.6	3.9	4.1	4.3	4.6
Boiler	.4	.2	.2	.1	.2	.1	.1	.1
Other	.5	.4	.6	.7	.7	.8	.4	.7
Total steam	22.1	21.5	21.8	22.9	23.1	23.9	24.5	24.7
Sullivan County:								
Lump	--------	--------	--------	--------	--------	--------	--------	--------
Broken	4.2	5.0	.1	.4	1.9	(4)	--------	.2
Egg	6.4	10.0	7.7	8.8	9.2	[4] 4.9	4.1	7.3
Stove	9.9	16.4	14.5	17.1	19.1	18.1	18.5	26.2
Chestnut	15.4	21.8	18.6	22.3	23.3	19.4	23.6	26.0
Pea	9.1	15.8	9.6	11.5	12.4	8.7	7.8	7.7
Total domestic	45.0	69.0	50.5	60.1	65.9	51.1	54.0	67.4
Boiler, screenings, etc	55.0	31.0	49.5	39.9	34.1	48.9	46.0	32.6
Grand total:								
Lump	(1)	(1)	(1)	(1)	(1)	(2)	--------	(1)
Broken	4.3	5.0	2.7	2.6	1.6	[2] 1.0	.7	.6
Egg	14.5	15.7	14.5	13.5	13.5	11.7	11.7	11.4
Stove	21.5	19.6	22.2	24.4	25.1	25.9	25.6	25.8
Chestnut	[3] 25.8	[3] 25.6	[3] 26.5	[3] 26.8	[3] 27.1	26.4	25.4	25.6
Pea	7.8	8.0	8.3	5.6	5.5	6.2	7.8	8.1
Total domestic	73.9	73.9	74.2	72.9	72.8	71.2	71.2	71.5
Buckwheat No. 1	13.0	12.9	12.3	12.4	11.4	12.8	13.2	13.2
Buckwheat No. 2 (rice)	6.6	6.6	6.5	7.4	7.6	7.6	7.8	7.3
Buckwheat No. 3 (barley)	5.2	5.7	6.1	6.2	6.5	6.9	6.8	7.0
Boiler	.3	.2	.1	.1	.5	.1	.1	.1
Other	1.0	.7	.8	1.0	1.2	1.4	.9	.9
Total steam	26.1	26.1	25.8	27.1	27.2	28.8	28.8	28.5

[1] Less than one-tenth of 1 per cent.
[2] A small amount of lump coal is included with broken.
[3] Includes range coal.
[4] A small amount of broken coal is included with egg.

A summary of shipments by sizes for the last 11 years is given in Table 17A. In comparison with 1928, the percentage of pea in breaker shipments in 1929 increased, the percentage of sizes below pea declined, and the percentage of sizes above pea remained the same. The total shipments, which include dredge and washery coal, showed much the same tendency in 1929, except that the shipments of sizes above pea increased from 61.8 to 62.6 per cent.

TABLE 17A.—*Shipments of anthracite from breakers and total from all operations, classified by sizes, 1919–1929*

[A table separating shipments of domestic sizes from pea and steam for each year from 1890 to 1924, excluding, however, Sullivan County and dredge coal, will be found in Coal in 1924, p. 575]

	Sizes above pea		Pea		Sizes below pea		Total (gross tons)
	Gross tons	Percentage of total	Gross tons	Percentage of total	Gross tons	Percentage of total	
Breaker product:							
1919	42, 937, 454	66. 4	5, 884, 492	9. 1	15, 809, 757	24. 5	64, 631, 703
1920	42, 209, 170	66. 4	5, 008, 050	7. 9	16, 381, 463	25. 7	63, 598, 683
1921	45, 796, 115	67. 4	5, 720, 904	8. 4	16, 464, 397	24. 2	67, 981, 416
1922	25, 046, 679	66. 1	2, 967, 355	7. 8	9, 892, 469	26. 1	37, 906, 503
1923	45, 651, 693	65. 9	5, 544, 915	8. 0	18, 091, 818	26. 1	69, 288, 426
1924	44, 566, 747	65. 9	5, 593, 926	8. 3	17, 431, 597	25. 8	67, 592, 270
1925	31, 359, 250	67. 3	2, 608, 744	5. 6	12, 647, 429	27. 1	46, 615, 423
1926	44, 301, 428	67. 3	3, 636, 137	5. 5	17, 888, 624	27. 2	65, 826, 189
1927	39, 732, 320	65. 0	3, 780, 481	6. 2	17, 617, 143	28. 8	61, 129, 944
1928	36, 550, 918	63. 4	4, 503, 801	7. 8	16, 580, 787	28. 8	57, 635, 506
1929	36, 325, 442	63. 4	4, 636, 115	8. 1	16, 363, 354	28. 5	57, 324, 911
Total shipments:[1]							
1919	43, 349, 551	63. 8	6, 237, 398	9. 2	18, 385, 346	27. 0	67, 972, 295
1920	42, 984, 656	62. 6	5, 457, 588	8. 0	20, 168, 519	29. 4	68, 610, 763
1921	46, 051, 199	66. 2	5, 865, 379	8. 4	17, 637, 985	25. 4	69, 554, 563
1922	25, 409, 723	61. 8	3, 278, 136	8. 0	12, 385, 979	30. 2	41, 073, 838
1923	46, 479, 297	63. 3	5, 928, 618	8. 1	21, 019, 797	28. 6	73, 427, 712
1924	44, 825, 550	65. 0	5, 689, 000	8. 2	18, 456, 431	26. 8	68, 970, 981
1925	31, 518, 719	65. 7	2, 682, 372	5. 6	13, 806, 384	28. 7	48, 007, 475
1926	44, 601, 096	66. 3	3, 699, 294	5. 5	18, 948, 556	28. 2	67, 248, 946
1927	39. 861, 493	63. 3	3, 887, 666	6. 2	19, 193, 061	30. 5	62, 942, 220
1928	36, 669, 756	61. 8	4, 596, 675	7. 7	18, 097, 498	30. 5	59, 363, 929
1929	36, 510, 978	62. 6	4, 686, 857	8. 1	17, 100, 896	29. 3	58, 298, 731

[1] Includes shipments of washery and dredge coal.

At this point it should be noted that the classifications used in the preceding tables are not always the same. Tables 14A, 15A, and the second half of 17A include all anthracite shipments. Tables 16A and the first half of 17A include all shipments from breakers and exclude dredge and washery coal. These differences should be kept in mind when comparisons are made.

LOCAL SALES

Shipments to points outside the mining area absorb most of the production of anthracite and provide most of the industry's gross revenue, but considerable tonnages are also sold in the thriving communities within the anthracite region itself. These "local sales" (as they are designated in the tables of this report) plus the shipments constitute the commercial or revenue-producing part of the production.

In 1929 local sales amounted to 2,886,628 tons, or 4.4 per cent of the total output, and a gain of 43,034 tons over 1928. In 1913 they amounted to 1,793,814 tons; in 1919, to 2,107,876 tons; and in 1923, to 2,900,314 tons. For recent years they constitute 3 to 4 per cent of the total production as against 2.4 per cent before the war. While the quantity of anthracite sold locally generally increased during the past 10 years, at least a part of the year-to-year fluctuations in the proportion of total output represented by local sales is explained by changes in the output. (Table 18A.)

TABLE 18A.—*Disposition of total output of anthracite, 1890–1929, in per cent*

Year	Shipments	Local sales	Colliery fuel	Year	Shipments	Local sales	Colliery fuel
1890	88.3	4.3	7.4	1922	84.1	4.4	11.5
1895	89.8	2.3	7.9	1923	88.1	3.5	8.4
1900	88.4	2.1	9.5	1924	87.8	3.5	8.7
1905	88.9	2.0	9.1	1925	87.0	4.7	8.3
1910	87.1	2.4	10.5	1926	89.2	3.2	7.6
1915	86.4	2.4	11.2	1927	88.0	3.8	8.2
1919	86.4	2.7	10.9	1928	88.3	4.2	7.5
1920	85.8	3.2	11.0	1929	88.4	4.4	7.2
1921	86.1	3.1	10.8				

To throw light on the character of the local market, the bureau addressed a supplementary inquiry to each producer asking for a statement of the sizes sold locally. The data thus obtained are tabulated for the years 1926 to 1929 to show local sales of breakers and washeries and of dredges in Table 19A. The figures for 1929 are the most complete, 97.2 per cent of the local sales by breakers and washeries and 98.9 per cent of those by dredges being accounted for.

TABLE 19A.—*Tabulation of reports of certain operators of breakers, washeries, and dredges as to the sizes of anthracite sold locally, 1927–1929*

Size	1927		1928		1929	
	Gross tons	Per cent of total	Gross tons	Per cent of total	Gross tons	Per cent of total
Breakers and washeries						
Lump	552	(1)	58	(1)	1,460	0.1
Broken	9,918	0.5	19,923	0.8	24,881	1.0
Egg	12,059	.6	15,914	.7	19,555	.8
Stove	64,405	3.4	77,934	3.2	80,385	3.3
Chestnut	742,616	38.8	796,313	33.0	750,024	30.4
Pea	454,439	23.7	751,890	31.2	844,455	34.2
Buckwheat No. 1	236,395	12.3	349,069	14.5	338,445	13.7
Buckwheat No. 2	171,911	9.0	194,857	8.1	187,952	7.6
Buckwheat No. 3	141,507	7.4	147,603	6.1	164,306	6.7
Boiler	78,763	4.1	55,237	2.3	51,839	2.1
Other	3,121	.2	2,081	.1	2,945	.1
	1,915,686	100.0	2,410,879	100.0	2,466,247	100.0
Total local sales from breakers and washeries	2,351,869		2,497,709		2,537,168	
Percentage of total local sales accounted for, by sizes		81.5		96.5		97.2
Dredges						
Egg						
Stove	22	(1)	193	.1	129	(1)
Chestnut	104	(1)	644	.2	160	(1)
Pea	1,099	.2	1,739	.6	1,344	.4
Buckwheat No. 1	7,143	1.5	7,320	2.4	10,252	3.1
Buckwheat No. 2	12,186	2.6	7,406	2.5	14,218	4.1
Buckwheat No. 3	50,640	10.7	22,800	7.5	25,275	7.3
Boiler	63,140	13.3	69,499	22.9	96,122	27.8
Other [2]	340,721	71.7	193,536	63.8	198,069	57.3
	475,055	100.0	303,137	100.0	345,569	100.0
Total local sales from dredges	368,461		345,885		349,460	
Percentage of total local sales accounted for, by sizes		77.6		87.6		98.9

[1] Less than one-tenth of 1 per cent.

[2] Mainly unsized river coal.

Local sales from breakers and washeries are seen to consist largely of chestnut, pea, and buckwheat No. 1. In total breaker shipments outside the region chestnut made up 25.6 per cent in 1929, while in local sales of companies reporting it made up 30.4 per cent. Pea made up only 8.1 per cent of the breaker shipments, but comprised 34.2 per cent of the local sales of the companies reporting. Buckwheat No. 1, which made up 13.7 per cent of the local sales, was 13.2 per cent of the breaker shipments. Between 1926 and 1929 the proportion of both pea and buckwheat No. 1 in local sales had more than doubled. The large proportion of the smaller sizes in the trade within the region helps to explain the lower average value of local sales as compared with the value of shipments.

In 1929, 349,460 tons or 54.6 per cent of the total output of dredge coal was sold locally. Steam sizes comprised all but a small quantity of this tonnage.

TRENDS IN VALUES AND PRICES

SOURCES OF INFORMATION AND METHODS OF ANALYSIS

Margins of sales agents not included.—The valuation figures in this study represent value at the breaker or washery, as reported by the operating companies. In making its report the company is requested to "estimate value of the product not sold" and to "exclude selling expenses."

From this it will be seen that where a producing company sells its output to a separately organized sales company—the practice of many, including certain of the largest producers—the value reported will exclude the margin of the sales company and may therefore be somewhat less than the circular price at which the coal in question is placed on the general market. One should bear this fact in mind in considering the variations between different regions shown in the tables for the same sizes of coal.[23]

Estimates included in the figures of value.—The reports are furnished in writing and signed by responsible officers of the mining companies. Complete reports have been received from all operators as to tonnage produced and the physical operation of the mines. A few companies made no reply on the value of the product, however, and to round out the totals, estimates of these values have been made. The estimates represent only 13 per cent of the value shown in 1929 because, aside from a few extremely small producers, only one company failed to report. The values for this company, a producer in the Wyoming region, were estimated in 1929 as follows: The tonnage it reported of each size from broken to pea was multiplied by the company's average circular price for that size, as quoted in the trade journals for the year. The tonnage that it reported for buckwheat No. 1 and each smaller size was multiplied by the average sales realization obtained on that size by all other producers in the Wyoming region.

This method of computation gives results that are exactly comparable with those of 1926, 1927, and 1928, with a single exception (buckwheat No. 1 in 1926). Before 1926 a different method of computation was used. The change in method introduced a slight break in the comparability of the figures, the extent of which was fully discussed in Coal in 1926, pages 576 to 580.

AVERAGE SALES REALIZATIONS, 1922–1929

The average sales realizations on each size from 1922 to 1929 are given in Table 20A. To insure comparability, the table is based on shipments of breaker coal only, the dredge and washery product being excluded.

Further declines on domestic sizes.—Average realizations on each of the domestic sizes, which, with the exception of pea and egg, had increased from 1921 to 1926, have decreased steadily during the last three years. (Table 20A.) With the exception of stove coal, which remained at the same figure as in the previous year, each of the domestic grades shows a drop in value in 1929, and in comparison with 1928 the reductions ranged from 6 cents a ton on chestnut to 34 cents a ton on pea. On all domestic sizes combined, including pea, the decrease from 1928 to 1929 was 9 cents a ton.

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[23] See Gordon, E. B., Distribution of Anthracite: U. S. Coal Commission Rept., 1925, pt. 2, pp. 677, 681, and 682, for a statement of the marketing arrangements of the principal companies and the quantities handled through sales agents.

Prices of pea coal.—The average sales realization on pea coal, which in 1928 dropped to the lowest level for any year since 1919, dropped still further in 1929. From 1921 to 1923 pea brought increasing returns, the average receipts rising from $5.74 in 1921 to $6.18 in 1923. Thereafter, prices dropped to $5.60 in 1924 and $5.27 in 1925. In the next two years sales realizations were $5.98 and $5.90, respectively, and the sharp reduction of 90 cents in 1928 meant a decrease of at least $3,500,000 to the industry. In 1929 the average realization on pea was $4.66, a decline of 34 cents as compared with the average for 1928.

Prices of steam sizes in 1929.—In 1927 and 1928 the decline in the price of domestic sizes was partly offset by increases in the price of steam sizes. Last year, however, there was a perceptible weakening of values realized on the steam sizes. In comparison with 1928 the realizations on buckwheat No. 1 declined 12 cents a ton; on buckwheat No. 2, 8 cents; and on buckwheat No. 3, 5 cents. For all steam sizes combined the decrease from 1928 to 1929 was 8 cents a ton. The prices on buckwheat Nos. 2 and 3 are now back to the approximate level of two years ago. The average realizations on steam sizes, computed in a manner exactly comparable from year to year, have been as follows:

	1921	1922	1923	1924	1925	1926	1927	1928	1929
Buckwheat No. 1	$3.43	$3.56	$3.48	$2.94	$2.49	[1] $2.39	$2.56	$2.75	$2.63
Buckwheat No. 2 (rice)	2.27	2.37	2.23	1.93	1.84	1.78	1.78	1.85	1.77
All steam sizes	2.75	2.77	2.64	2.25	2.00	[1] 1.88	1.98	2.12	2.04

[1] These figures differ from the corresponding ones in Table 20A, in computing which the value of the buckwheat No. 1 shipped by one large company in the Wyoming region was taken at the company's circular price. The figures for 1926 here given are computed by taking the value of this company's tonnage at the average sales realization obtained by other shippers in the Wyoming region.

Average value for all sizes.—The average realizations on all sizes combined in 1929 was $6.30 per ton, as compared with $6.38 in the preceding year. This average was the lowest realized by anthracite operators since 1921. The downward trend in average realizations during the past three years is in striking contrast to the steady increase that characterized the period from 1916 to 1923.

TABLE 20A.—*Average sales realization per gross ton on anthracite shipments from breakers, by regions and sizes, 1922–1929*

[Value does not include margins of separately incorporated sales companies]

Region and size of coal	1922	1923	1924	1925	1926	1927	1928	1929
Lehigh:								
Lump	--------	--------	--------	--------	$8.60	(1)	--------	(1)
Broken	$7.73	$8.01	$8.32	$8.04	8.39	[1] $8.29	$8.04	[1] $7.96
Egg	8.03	8.69	8.78	8.61	9.03	8.48	8.35	8.21
Stove	8.06	8.65	9.10	9.02	9.34	8.98	8.75	8.65
Chestnut	8.03	8.60	8.95	8.65	8.93	8.46	8.32	8.31
Pea	5.93	6.34	5.90	5.48	6.10	6.02	5.01	4.60
Total domestic	7.69	8.31	8.53	8.41	8.75	8.35	8.02	7.92
Buckwheat No. 1	3.66	3.60	2.96	2.53	2.38	2.53	2.73	2.61
Buckwheat No. 2 (rice)	2.55	2.49	2.08	1.92	1.85	1.91	1.91	1.82
Buckwheat No. 3 (barley)	1.75	1.55	1.48	1.45	1.40	1.40	1.40	1.33
Total steam [2]	2.86	2.70	2.25	1.95	1.72	1.86	2.05	1.98
Total, all sizes	6.23	6.58	6.61	6.40	6.29	6.09	6.09	6.02

[1] An insignificant quantity of lump is included with the broken coal.
[2] Includes all other steam sizes.

TABLE 20A.—*Average sales realization per gross ton on anthracite shipments from breakers, by regions and sizes, 1922–1929*—Continued

Region and size of coal	1922	1923	1924	1925	1926	1927	1928	1929
Schuylkill:								
Lump	$7.70	$8.35	$5.18	$8.85	$9.32	(1)	--------	(1)
Broken	8.30	8.79	8.71	8.67	9.25	[1] $8.88	$8.58	[1] $8.17
Egg	8.12	8.85	8.75	8.62	9.04	8.42	8.38	8.27
Stove	8.27	8.87	9.16	9.06	9.36	9.00	8.81	8.79
Chestnut	[3] 8.28	8.86	9.00	8.75	9.04	8.48	8.38	8.24
Pea	6.07	6.35	5.68	5.30	6.05	5.93	4.96	4.55
Total domestic	7.97	8.49	8.50	8.45	8.83	8.37	8.07	7.96
Buckwheat No. 1	3.50	3.43	2.69	2.38	2.34	2.49	2.65	2.50
Buckwheat No. 2 (rice)	2.29	2.18	1.91	1.79	1.68	1.65	1.77	1.70
Buckwheat No. 3 (barley)	1.50	1.35	1.23	1.22	1.25	1.25	1.36	1.29
Total steam [2]	2.65	2.57	2.04	1.83	1.77	1.84	1.99	1.88
Total, all sizes	6.30	6.56	6.46	6.21	6.59	6.06	5.93	5.85
Wyoming:								
Lump	--------	--------	--------	--------	--------	--------	--------	--------
Broken	7.42	7.57	7.73	7.78	[4] 7.96	7.94	7.89	7.78
Egg	7.80	8.31	8.29	8.27	[4] 8.62	8.31	8.31	8.15
Stove	7.91	8.40	8.50	8.63	[4] 9.01	8.78	8.68	8.71
Chestnut	[3] 7.96	[3] 8.35	[3] 8.34	[3] 8.31	[3,4] 8.59	8.31	8.27	8.24
Pea	5.80	5.96	5.45	5.14	[4] 5.89	5.83	5.01	4.74
Total domestic	7.70	8.09	8.08	8.21	[4] 8.58	8.31	8.12	8.03
Buckwheat No. 1	3.58	3.48	3.11	2.55	[4] 2.66	[5] 2.61	[5] 2.82	[5] 2.72
Buckwheat No. 2 (rice) [6]	2.35	2.18	1.91	1.85	1.81	1.82	1.88	1.80
Buckwheat No. 3 (barley)	1.57	1.40	1.29	1.38	1.34	1.37	1.40	1.38
Total steam [2]	2.83	2.67	2.40	2.15	[4] 2.13	2.13	2.24	2.17
Total, all sizes	6.62	6.92	6.85	6.83	[4] 7.10	6.83	6.68	6.58
Total, including Sullivan County:								
Lump	7.70	8.35	5.18	8.85	[4] 9.32	(1)	--------	(1)
Broken	7.65	7.85	7.93	7.94	[4] 8.19	[1] 8.17	8.10	[1] 7.93
Egg	7.91	8.49	8.45	8.39	[4] 8.75	8.35	8.33	8.18
Stove	8.03	8.56	8.74	8.79	[4] 9.14	8.86	8.72	8.72
Chestnut	[3] 8.07	[3] 8.53	[3] 8.59	[3] 8.48	[3,4] 8.75	8.38	8.31	8.25
Pea	5.92	6.18	5.60	5.27	[4] 5.98	5.90	5.00	4.66
Total domestic	7.77	8.23	8.25	8.30	[4] 8.66	8.33	8.09	8.00
Buckwheat No. 1	3.56	3.48	2.94	2.49	[4] 2.52	[5] 2.56	[5] 2.75	[5] 2.63
Buckwheat No. 2 (rice) [6]	2.37	2.23	1.93	1.84	1.78	1.78	1.85	1.77
Buckwheat No. 3 (barley)	1.57	1.41	1.30	1.32	1.32	1.32	1.38	1.33
Total steam [2]	2.77	2.64	2.25	2.00	[4] 1.94	1.98	2.12	2.04
Total, all sizes	6.48	6.77	6.70	6.59	[4] 6.84	6.50	6.38	6.30

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[1] An insignificant quantity of lump is included with the broken coal.

[2] Includes all other steam sizes.

[3] Includes range coal.

[4] The figures are based on complete reports of tonnage and value from all important producers except one company in the Wyoming region which reported the tonnage of each size but not the value. To round out the totals, estimates of the value of this company's shipments were made. In 1926 a change in the method of estimate was introduced which yields a more accurate result. The figures for 1926, 1927, 1928, and 1929, as shown above (except for buckwheat No. 1), are therefore strictly comparable with each other but not with those for earlier years. The effect of the change in method is shown by the following statement of the averages for 1926 if calculated according to the method of estimate used in 1920–1925:

	Broken	Egg	Stove	Chestnut	Pea	Total domestic	Buckwheat No. 1	Total steam	All sizes
Wyoming	$7.92	$8.49	$8.92	$8.48	$5.87	$8.48	$2.42	$2.02	$7.00
All regions	8.15	8.66	9.09	8.69	5.98	8.60	2.39	1.88	6.78

The change in method of estimate is fully discussed in Coal in 1926, p. 576.

[5] The average for buckwheat No. 1 in 1927–1929 was computed according to the method used in 1920–1925.

[6] Includes bird's-eye coal.

AVERAGE VALUES OF SHIPMENTS, LOCAL SALES, AND COLLIERY FUEL

Table 21A shows by regions the average value per ton for all shipments, all local sales, and colliery fuel in each year from 1919 to 1929. The receipts from local sales average distinctly lower than those from shipments, a difference mainly accounted for by the large proportion of the smaller sizes in the local sales. (See Table 19A.) In 1929 shipments brought $6.24 and local sales, $4.85 or $1.39 less.

The figures in the following table include the sales of dredge and washery coal as well as breaker coal.

TABLE 21A.—*Average value per gross ton of anthracite shipped, local sales, used for power, and total production, by regions, 1919–1929*[1]

Year and region	Shipments	Local sales	Used for power	Total	Year and region	Shipments	Local sales	Used for power	Total
1919					1925				
Lehigh	$4.86	$3.37	$1.80	$4.51	Lehigh	$6.24	$4.49	$1.57	$5.79
Schuylkill	4.94	3.43	.85	4.31	Schuylkill	5.98	4.06	.42	5.22
Wyoming	5.21	4.55	1.55	4.85	Wyoming	6.78	6.01	1.12	6.37
Sullivan County	4.63	4.70	2.29	4.36	Sullivan County	5.49	6.93	1.85	5.05
	5.08	3.98	1.32	4.64		6.47	5.06	.88	5.94
1920					1926				
Lehigh	5.88	3.29	1.94	5.34	Lehigh	6.29	4.85	2.34	6.01
Schuylkill	5.70	4.14	.90	4.99	Schuylkill	6.41	3.98	.93	5.77
Wyoming	6.15	5.17	1.80	5.71	Wyoming	[2] 7.05	5.77	1.46	[2] 6.63
Sullivan County	5.60	5.71	2.33	5.27	Sullivan County	5.90	7.06	1.08	5.23
	5.97	4.44	1.47	5.43		[2] 6.76	4.95	1.35	[2] 6.29
1921					1927				
Lehigh	6.13	3.50	1.59	5.54	Lehigh	6.04	4.49	2.40	5.73
Schuylkill	6.03	4.19	.65	5.22	Schuylkill	5.77	4.14	.42	5.13
Wyoming	6.29	5.64	1.27	5.82	Wyoming	6.79	5.72	1.30	6.36
Sullivan County	6.21	6.20	2.30	5.53	Sullivan County	4.67	7.03	1.50	4.21
	6.20	4.75	1.08	5.60		6.37	4.97	1.07	5.89
1922					1928				
Lehigh	6.05	3.97	2.34	5.56	Lehigh	6.04	4.83	2.37	5.74
Schuylkill	5.78	4.44	.78	4.98	Schuylkill	5.64	4.07	1.76	5.19
Wyoming	6.52	5.78	1.69	6.02	Wyoming	6.63	5.59	1.44	6.26
Sullivan County	5.22	6.18	2.00	4.84	Sullivan County	5.08	6.86	1.75	4.59
	6.21	5.07	1.38	5.61		6.25	4.98	1.68	5.85
1923					1929				
Lehigh	6.36	3.80	1.77	5.84	Lehigh	5.97	5.34	2.38	5.71
Schuylkill	6.31	3.87	.72	5.63	Schuylkill	5.71	3.91	1.75	5.25
Wyoming	6.81	5.92	1.43	6.40	Wyoming	6.56	5.34	1.48	6.19
Sullivan County	6.81	6.56	2.60	6.73	Sullivan County	5.99	7.39	1.80	5.25
	6.60	4.80	1.21	6.08		6.24	4.85	1.70	5.85
1924									
Lehigh	6.54	4.53	1.68	6.03					
Schuylkill	6.33	4.05	.45	5.57					
Wyoming	6.81	6.14	.97	6.36					
Sullivan County	5.11	7.15	1.98	5.10					
	6.63	5.15	.87	6.08					

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[1] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[2] See Table 20A, footnote 4. Had the same method of computation been used as in earlier years the average value for shipments for the Wyoming region would have been $6.94 and for all regions $6.70, and the average value of the total production for the Wyoming region would have been $6.54 and for all regions $6.24.

NUMBER OF OPERATIONS

In 1929 there were 297 active anthracite operations, including breakers, washeries, and dredges. This number was two less than in the preceding year. Both the Lehigh and Schuylkill regions had a smaller number of active operations in 1929 than in 1928, but these losses were partly offset by the addition of six breakers in the Wyoming region. In Sullivan County the number of operations remained the same as in 1928.

Of the total number of active operations in 1929, 229 were breakers, 49 were dredges, and 19 were washeries. Compared with 1928 there was an increase of three in the number of breakers, a decrease of 5 in the number of washeries, and the number of dredges remained the same.

Table 22A.—*Number of anthracite breakers, washeries, and dredges active, 1920–1929*

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Lehigh:										
Breakers	36	33	32	33	33	32	33	32	31	29
Washeries	10	11	11	12	6	6	1	------	------	------
Dredges	3	1	4	3	3	2	1	2	2	2
	49	45	47	48	42	40	35	34	33	31
Schuylkill:										
Breakers	78	79	78	78	78	76	77	75	74	73
Washeries	19	17	24	26	13	7	11	9	9	7
Dredges	56	59	56	56	45	49	46	43	47	47
	153	155	158	160	136	132	134	127	130	127
Wyoming:										
Breakers	135	130	131	144	133	128	127	126	119	125
Washeries	33	27	34	44	22	22	26	13	15	12
Dredges	1	2	2	1	1	2	2	------	------	------
	169	159	167	189	156	152	155	139	134	137
Sullivan County: Breakers	3	3	2	2	3	2	2	2	2	2
Total breakers	252	245	243	257	247	238	239	235	226	229
Total washeries	62	55	69	82	41	35	38	22	24	19
Total dredges	60	62	62	60	49	53	49	45	49	49
Grand total	374	362	374	399	337	326	326	302	299	297

LABOR STATISTICS

One of the outstanding features of the anthracite industry in 1929 was the sharp reduction in the labor force. The total number of men and boys at work in the mines, dredges, and preparation plants, not including supervisory and office workers, was 151,501. This number is 9,180 less than in 1928 and brings the total number of workers displaced during the last three years to 13,885. Not since 1920 has a smaller number of workers been employed by the anthracite industry.

Although fewer workers were employed, those retaining their jobs enjoyed steadier employment, the average number of days worked increasing from 217 in 1928 to 225 days in 1929. The average for 1929, however, falls short of the record for many earlier years when the anthracite mines offered almost full-time employment. (Table 23A.)

The year was free from major labor disturbances, and local strikes and suspensions played a relatively unimportant part in the employment situation. Table 24A shows that only 272,511 man days were lost in 1929, which was considerably less than in 1928 but slightly more than in 1927.

TABLE 23A.—*Men employed and days worked in the anthracite field, by regions, 1928 and 1929*

Region	Average number employed						Average number of days worked
	Surface	Underground				Total	
		Miners and their laborers[1]	Haulage and track	Other	Total		
1928							
Lehigh:							
Breakers	5,596	8,385	1,526	4,128	14,039	19,635	211
Dredges	9					9	185
	5,605	8,385	1,526	4,128	14,039	19,644	211
Schuylkill:							
Breakers	12,763	22,580	3,919	7,999	34,498	47,261	209
Washeries	466					466	174
Dredges	300					300	191
	13,529	22,580	3,919	7,999	34,498	48,027	209
Wyoming:							
Breakers	17,272	50,401	10,668	13,873	74,942	92,214	222
Washeries	244					244	241
	17,516	50,401	10,668	13,873	74,942	92,458	222
Sullivan County: Breakers	135	261	70	86	417	552	109
Total breakers	[2] 35,766	81,627	16,183	26,086	123,896	159,662	217
Total washeries	710					710	197
Total dredges	309					309	191
Grand total	36,785	81,627	16,183	26,086	123,896	160,681	217
1929							
Lehigh:							
Breakers	5,134	8,266	1,419	3,772	13,457	18,591	227
Dredges	16					16	180
	5,150	8,266	1,419	3,772	13,457	18,607	227
Schuylkill:							
Breakers	11,397	20,035	3,539	8,007	31,581	42,978	215
Washeries	344					344	121
Dredges	293					293	197
	12,034	20,035	3,539	8,007	31,581	43,615	214
Wyoming:							
Breakers	16,089	48,778	9,890	13,689	72,357	88,446	231
Washeries	242					242	192
	16,331	48,778	9,890	13,689	72,357	88,688	231
Sullivan County: Breakers	130	316	75	70	461	591	98
Total breakers	[2] 32,750	77,395	14,923	25,538	117,856	150,606	225
Total washeries	586					586	150
Total dredges	309					309	196
Grand total	33,645	77,395	14,923	25,538	117,856	151,501	225

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[1] Operators were requested to give number of "all miners (contract, consideration, and company) and their laborers."

[2] Includes a comparatively small number of washery employees who could not be separated from breaker employees.

TABLE 24A.—*Strikes, suspensions, and lockouts in the anthracite region, 1923–1929*

	Lehigh	Schuylkill	Wyoming	Sullivan County	Total
1923					
Total number employed	20, 639	49, 350	86, 978	776	157, 743
Men on strike	18, 593	43, 524	72, 772	696	135, 585
Man days lost account strike	354, 830	805, 640	1, 456, 364	12, 584	2, 629, 418
Average days lost:					
Per man employed	17	16	17	16	17
Per man on strike	19	19	20	18	19
1924					
Total number employed	20, 331	50, 456	88, 504	718	160, 009
Men on strike	10, 145	12, 333	48, 795		71, 273
Man days lost account strike	151, 243	86, 429	905, 958		1, 143, 630
Average days lost:					
Per man employed	7	2	10		7
Per man on strike	15	7	19		16
1925					
Total number employed	19, 579	50, 745	89, 399	589	160, 312
Men on strike	18, 751	45, 715	82, 876	586	147, 928
Man days lost account strike	1, 863, 605	4, 675, 143	8, 661, 264	69, 494	15, 269, 506
Average days lost:					
Per man employed	95	92	97	118	95
Per man on strike	99	102	105	119	103
1926					
Total number employed	20, 133	50, 138	94, 469	646	165, 386
Men on strike	17, 074	44, 309	83, 381	612	145, 376
Man days lost account strike	723, 550	1, 825, 482	3, 415, 913	25, 532	5, 990, 477
Average days lost:					
Per man employed	36	36	36	40	36
Per man on strike	42	41	41	42	41
1927					
Total number employed	20, 253	50, 313	94, 069	624	165, 259
Men on strike	5, 073	2, 991	12, 414		20, 478
Man days lost account strike	20, 112	5, 771	133, 359		159, 242
Average days lost:					
Per man employed	1	(1)	1		1
Per man on strike	4	2	11		8
1928					
Total number employed	19, 644	48, 027	92, 458	552	160, 681
Men on strike	7, 872	1, 158	27, 098		36, 128
Man days lost account strike	33, 720	3, 299	363, 663		400, 682
Average days lost:					
Per man employed	2	(1)	4		2
Per man on strike	4	3	13		11
1929					
Total number employed	18, 607	43, 615	88, 688	591	151, 501
Men on strike	8, 433	778	30, 566		39, 777
Man days lost account strike	118, 832	816	152, 863		272, 511
Average days lost:					
Per man employed	6	(1)	2		2
Per man on strike	14	1	5		7

[1] Less than one-half day.

METHODS OF MINING

The natural difficulties encountered in mining anthracite have tended to handicap the progress of mechanization in underground workings. Relatively thin, pitching beds with faults and irregularities have discouraged the introduction of much of the improved machinery that has multiplied the daily output of workers in many of the bituminous fields. As a result, out of the 64,174,655 tons of fresh-mined coal produced in 1929 only 1,035,634 tons, or 1.6 per cent, was cut by machines. (Table 25A.) This tonnage is slightly less than in 1928 when 1,151,615 tons was cut by machine. The total output of mechanically cut anthracite in 1929 was obtained with 137 mining machines, of which 118 were used in the Wyoming region, 15 in Sullivan County, and 4 in the Schuylkill region. In the Lehigh region no cutting machines were reported in use during the year.

As shown in Table 26A, strip mining is carried on in all three of the major producing regions. In 1929 the total output by strip mining was 1,706,934 tons, or 21.1 per cent less than in 1928. Of the total tonnage mined by stripping during the year, 849,152 tons or nearly half was produced in the Lehigh region.

TABLE 25A.—*Anthracite mined by machines, 1927–1929*

Region	1927		1928		1929	
	Number of machines	Gross tons	Number of machines	Gross tons	Number of machines	Gross tons
Lehigh	1	(1)	1	(1)	----------	----------
Schuylkill	1	(1)	1	(1)	4	13,894
Wyoming	121	[1] 983,829	176	[1] 1,093,055	118	978,559
Sullivan County	15	62,500	15	58,560	15	43,181
	138	1,046,329	193	1,151,615	137	1,035,634

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[1] Lehigh and Schuylkill included with Wyoming.

TABLE 26A.—*Anthracite recovered from steam-shovel strip pits, 1927–1929*

Region	1927		1928		1929	
	Number of shovels	Gross tons	Number of shovels	Gross tons	Number of shovels	Gross tons
Lehigh	41	967,210	40	1,073,043	39	849,152
Schuylkill	45	745,696	45	881,191	35	688,288
Wyoming	26	209,555	23	209,091	24	169,494
	112	1,922,461	108	2,163,325	98	1,706,934

DREDGE OPERATIONS

In 1929, 49 dredges reported to the Bureau of Mines a production of 640,129 tons, valued at $626,187. In comparison with the previous year this is a decrease of 24 per cent in tonnage and 23.8 per cent in value.

The "river coal" consists chiefly of sizes equivalent to buckwheat No. 3 and boiler. It is sold mainly for steam-raising purposes, and prices obtained for dredge coal have averaged about $1 per gross ton in the last five years. The average of 98 cents per gross ton in 1929 was the same as in 1928 and, although lower than the averages for 1925 and 1926, represented a gain of 4 cents over 1924 and 6 cents over 1927. The average receipts per ton on all dredge coal sold, including local sales as well as shipments, have been as follows:

1922	$1.23	1926	$1.01
1923	.95	1927	.92
1924	.94	1928	.98
1925	1.02	1929	.98

In the winter dredging is handicapped by cold weather. The seasonal nature of the industry is shown by Table 28A, which gives the number of employees in each month.

TABLE 27A.—*Anthracite produced by dredges, by rivers, 1928 and 1929*

River (including tributaries)	Number of dredges	Gross tons	Value	River (including tributaries)	Number of dredges	Gross tons	Value
1928				1929			
Lehigh	2	79,736	$103,445	Lehigh	2	77,894	$91,136
Schuylkill	11	140,579	146,041	Schuylkill	11	119,393	123,602
Susquehanna	36	622,007	572,044	Susquehanna	36	442,842	411,449
	49	842,322	821,530		49	640,129	626,187

TABLE 28A.—*Number of employees on pay rolls of anthracite-dredge operations on the first day of each month, 1927–1929*

Month	1927	1928	1929	Month	1927	1928	1929
January	107	110	94	July	363	449	373
February	132	172	89	August	362	385	267
March	174	269	177	September	327	340	232
April	285	381	353	October	319	263	334
May	334	438	418	November	266	211	282
June	354	468	430	December	160	122	130